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Volume 68

1954



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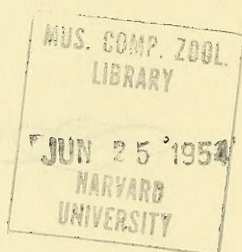
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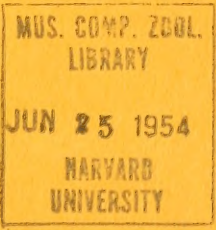
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NOTES ON FUNGI FROM NORTHERN CANADA

I. HYPOCREALES AND DISCOMYCETES¹

J. WALTON GROVES² and SHEILA C. HOARE³

DURING THE SUMMERS of 1948-51 biological survey parties, composed of members of the staffs of the Division of Botany and Plant Pathology and the Division of Entomology, under the sponsorship of the Defence Research Board, visited many parts of Northern Canada. The specimens of larger fungi collected during these surveys were received by the senior author and the identifications were carried out jointly with the junior author.

The material provided some interesting distribution records and extensions of range for some well known species, as well as some new Canadian records. The present paper lists only the Hypocreales and Discomycetes, but further papers on Boletaceæ, Agaricaceæ, and Gasteromycetes are in course of preparation.

For the operculate Discomycetes, the work of Seaver (1928) has been followed in general although, because the nomenclature in the book was based on the American Code, some changes were necessary in order to bring the nomenclature in line with the International Rules.

No attempt has been made to give the complete synonymy for each species as this would involve taxonomic research beyond the scope of the present work. The collectors and localities are listed below in connection with the individual specimens.

HYPOCREALES

Podostroma alutaceum (Pers. ex Fr.) Atk. Bot. Gaz. 40: 416. 1905.

Sphaeria alutacea Pers. Obs. Myc. 2: 66. 1797.

Sphaeria alutacea Fr. Syst. Myc. 2: 325. 1823.

Cordyceps alutacea Link Handb. z. Erkenn. der Gewächse 3: 347. 1833.

Hypocrea alutacea Tul. Sel. Fung. Carp. 1: 62. 1861.

Podocrea alutacea Lindau in Engler und Prantl. Pflanzenf. I, 1: 364. 1897.

This rare and interesting fungus was studied in culture by Atkinson (1905) who was able to establish that it was an autonomous plant and not a parasite on a *Clavaria* or *Spathularia*. The collection below consists of four fruit bodies 16-32 mm. high and the head 2-6 mm. in diameter in the dried condition. The head or fruiting portion is tan coloured and the stalk paler to yellowish buff. The heads vary from clavate to spathulate in shape. The asci become sixteen-spored by the separation of each of the eight original spores into two at the median septum. It is not possible to determine the attachment of these specimens, but there are fragments of sphagnum associated with them.

Specimen examined: DAOM⁴ 28494, Goose Bay, Labrador. Coll. W. B. Schofield (698), Aug. 10, 1949.

Cordyceps militaris (L. ex Fr.) Link Handb. z. Erkenn. der Gewächse 3: 347. 1833.

Clavaria militaris L. Sp. Pl. 1182. 1753.

Sphaeria militaris Fr. Syst. Myc. 2: 325. 1823.

Kentrosporium militare Wallr. Beitr. Bot. 166. 1844.

Torrubia militaris Tul. Sel. Fung. Carp. 3: 6. 1865.

This species, with bright orange, clavate fruit bodies, is one of the most frequently collected species of *Cordyceps*. It is usually found growing from lepidopterous pupæ, but in the collection below some of the fruit bodies are arising from larvæ. They differ from *C. elongata* Petch, reported on larvæ, in lacking a sterile apex, having more slender asci about 4 μ in diameter, in contrast to 7-8 μ described for *C. elongata*, and in the

1) Received for publication April 15, 1953. Contribution No. 1277 from the Division of Botany and Plant Pathology, Science Service, Department of Agriculture, Ottawa, Canada.

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4) The code letters DAOM refer to the Mycological Herbarium, Division of Botany and Plant Pathology, Science Service, Department of Agriculture, Ottawa.

filiform ascospores breaking up into segments. In all of these characters they agree with *C. militaris*.

Specimen examined: DAOM 29506, St. Anthony, Newfoundland. Coll. D. B. O. Savile (3012), Aug. 29, 1951.

Claviceps purpurea (Fr.) Tul. Ann. Sci. Nat. III, 20: 45. 1853.

Sphaeria purpurea Fr. Syst. Myc. 2: 325. 1823.

The ergot specimens cited below were determined by D. B. O. Savile and are included for the sake of completeness. Goodey (1952), acting on a suggestion from Savile, has shown that the record of ergot published by Linder (1947) was based on nematode galls. Savile comments with regard to his observations on ergot in the north, "Heavy at Great Whale River, light at Fort Churchill on same host. Churchill seems to be near the northern limit. It is definitely absent from Chesterfield Inlet."

Specimens examined: DAOM 25116, on *Elymus arenarius* L. var. *villosus* E. Meyer, Fort Churchill, Man. Coll. D.B.O. Savile (1593), Sept. 4, 1950. Savile 740, on *Elymus arenarius* L. var. *villosus* E. Meyer, Great Whale River, Quebec. Coll. D. B. O. Savile, Aug. 25, 1949. Savile 2846, on *Hierochloa odorata* (L.) Beauv., St. Anthony, Nfld. Coll. D. B. O. Savile, Aug. 11, 1951. Savile 3057, on *Deschampsia flexuosa* (L.) Trin., Port au Choix, Nfld. Coll. D. B. O. Savile, Sept. 8, 1951.

DISCOMYCETES

SCLEROTINIACEAE

Myriosclerotinia caricis-ampullaceae (Nyberg) Buchw. Friesia 3: 301. 1947.

Sclerotinia caricis-ampullaceae Nyberg, Mem. Soc. pro Fauna et Flora Fenn. 10: 20-23. 1934.

The genus *Myriosclerotinia* was erected by Buchwald (1947) to include a number of forms attacking Cyperaceae and Juncaceae. The genus was segregated from *Sclerotinia* principally on the basis of the characteristic spermatial fruiting structures, and was considered by Buchwald to form a natural group. These characteristic spermatial fruiting structures were given the name "spermodochidia" by Whetzel (1943a). Some of them have received names under *Epidocium* and *Myrioconium* in the Fungi Imperfecti.

The species of the genus *Myriosclerotinia* in general have rather large sclerotia, but those of *M. caricis-ampullaceae* are the largest

and most striking of any species known. The species is well described and illustrated by Whetzel (1943b, 1946) and he gives the size of the sclerotia as up to 20 cm. in length and up to 1 cm. thick at the base, tapering above to a slender, whip-like apex. In the specimen examined the largest sclerotium was about 10 cm. long and 7 mm. thick.

This species has been reported previously only from Finland, Sweden and the mountains of Wyoming.

Specimen examined: DAOM 25861, on *Carex aquatilis* Wahl., Gillam, Man. Coll. W. B. Schofield (957), June 13, 1950.

Myriosclerotinia longisclerotialis (Whetz.) Buchw. Kgl. Vet.-Landbohøskoles Aarskr. 1949: 156. 1949.

Sclerotinia longisclerotialis Whetz. Mycologia 21: 28. 1929.

This species is characterized by the long, slender sclerotia which either remain enclosed within the culms of the host or become only slightly exposed by a slit in the epidermis. According to Whetzel (1946) the size of the sclerotium varies with the species of *Carex* infected. So far as known, *M. longisclerotialis* does not occur outside of North America and Whetzel (1946) has reported two collections from the Timagami Forest Reserve, Ontario.

Specimen examined: DAOM 20699 on *Carex* sp., Churchill, Man. Coll. J. M. Gillett and W. Cody (1680), June 16, 1948.

Myriosclerotinia vahliana (Rostr.) Buchw. Friesia 3: 302. 1947.

Sclerotinia vahliana Rostr. Meddel. om Grønland 3: 607. 1891.

This species is distinct from other Sclerotiniaceae occurring on Cyperaceae by reason of the peculiar morphology of the sclerotia. These are more or less shell-like with the surface very irregularly curved and creased. It has been well described and illustrated by Whetzel (1946). He had examined material only from Greenland and from Denmark and Sweden, but the species would appear to be fairly common in northern Canada for seven different collections were received.

These specimens were all similar in gross appearance and possessed the characteristic sclerotia. However, on microscopic examination the asci and spores of three collections seemed definitely larger than in the other four. The smaller-spored forms agreed with the description by Whetzel (1946).

Table 1. Comparison of ascus and spore sizes in collections of *Myriosclerotinia vahliana*.

	asci	ascospores
Whetzel	109-164 x 7.8-10.4 μ	10.8-18.0 x 4.8-6.6 μ
Schofield 77	138-180 x 9.5-13.0 μ	11.0-17.0 x 5.0-7.0 μ
Schofield 83	158-172 x 9.5-11.0 μ	10.0-15.0 x 5.5-7.0 μ
Savile 1699	135-166 x 8.5-11.0 μ	12.0-15.0 x 4.5-5.5 μ
Savile 1064	135-160 x 9.0-11.0 μ	11.0-14.0 x 4.5-5.5 μ
Schofield 227	170-195 x 11.0-14.0 μ	14.0-18.0 x 7.0-9.0 μ
Cody 1149	155-180 x 10.0-13.0 μ	13.0-18.0 x 6.5-8.0 μ
Savile 1063	160-185 x 11.0-13.0 μ	14.0-17.0 x 5.5-7.0 μ

The actual measurements found are given in Table 1. It will be noted that the collections tend to fall into two groups, one having asci mostly less than 160 μ long and ascospores mostly less than 6 μ broad, and the other having asci mostly more than 160 μ long and ascospores mostly more than 6 μ broad. There is some overlapping but this range is outside the range of variation ordinarily found in the Sclerotiniaceae.

It is not unusual for more than one closely related species of the Sclerotiniaceae to occur on the same host, but the presence of the very characteristic sclerotia as well as the somewhat intermediate forms makes one hesitate to recognize the large-spored form as a distinct species. For the present it seems preferable merely to note the variation, and the possibility that a recognizable species or variety with larger spores may exist, but not to accord it any taxonomic status until it is possible to make comparative cultural studies of both forms.

Specimens examined: DAOM 29310, Resolute Bay, Cornwallis Island. Coll. W. B. Schofield (77), June 26, 1949. DAOM 29309, Allen Bay, Cornwallis Island. Coll. W. B. Schofield (83), July 2, 1949. DAOM 34442, St. Anthony, Nfld. Coll. D. B. O. Savile and J. Vaillancourt (1699), June 1, 1951. DAOM 34444, Chesterfield Inlet. Coll. D. B. O. Savile, C. T. Watts, and J. R. Vockeroth (1064), July 21, 1950. DAOM 20766, Southampton Island. Coll. W. Cody (1149), July 4, 1948. DAOM 29311, Resolute Bay, Cornwallis Island. Coll. W. B. Schofield (227), July 14, 1949. DAOM 34443, Chesterfield Inlet. Coll. D. B. O. Savile, C. T. Watts, and J. R. Vockeroth (1063), July 21, 1950. All specimens on *Eriophorum* sp.

HELOTIACEAE

Allophylaria pusiola (Karst.) Nannf. Nova Acta Regiae Soc. Sci. Upsal. 8: 290. 1932.

Peziza pusiola Karst. Hedw. 9: 117. 1870.

Crumenula pusiola Karst. Myc. Fenn. 1: 214. 1871.

Godronia pusiola Karst. Rev. Mon. Syn. Asc. Fenn. 144. 1885.

The apothecia in this species are very small, scarcely reaching 0.5 mm. in diameter, dark brown and somewhat urceolate. The asci measured 45-55 x 5.5-8.0 μ and the spores 8-11 x 2-3 μ . The species is not well known but appears to be a northern form. Seven specimens were noted in the herbarium at Uppsala, Sweden in 1950, under the name *Godronia pusiola*. These were all very scanty and were all on grasses from the far north.

As far as known there are no Canadian records of this fungus. The specimen cited below is from Alaska, but is included because of the interest and because it undoubtedly should occur also in northern Canada. The collection consists of fairly abundant material in good condition.

Specimen examined: DAOM 29445. On *Poa arctica* R. Br., Anchorage Road Junction, Kenai Peninsula, Alaska. Coll. J. A. Calder (5767), July 9, 1951.

HYALOSCYPHACEAE

Dasyscypha agassizii (Berk. & Curt.) Sacc. Syll. Fung. 8: 438. 1889.

Peziza agassizii Berk. & Curt. Grev. 3: 151. 1874-5.

Lachnella agassizii Seaver, N. Amer. Cup-Fungi. Inoperculates. p. 247. 1951.

This species is common and widely distributed, occurring most frequently on *Abies*

but sometimes on other conifers also. It is characterized by the white, hairy apothecia with orange discs and small spores about $6-10 \times 3-4 \mu$.

There has been considerable confusion and uncertainty concerning the name *Dasyscypha*. The genus was established by Fuckel (1870) and there has been disagreement among various authors as to which of the species he described should be accepted as the type. If *D. virginea* be accepted as the type of *Dasyscypha*, the genus *Trichoscyphella* Nannf. would be available for the group of species including *D. agassizii*. The proposal by Seaver (1951) that *Lachnella* be conserved for this group of Discomycetes is unacceptable because it would conserve *Lachnella* in a sense which excludes the type. *Dasyscypha* is used here in a broad sense which includes *D. agassizii*.

Specimens examined: DAOM 24995, Goose Bay, Labrador. Coll. J. M. Gillett and W. I. Findlay (5080), June 20, 1950. DAOM 26807, St. Anthony, Nfld. Coll. J. Vaillancourt and D. B. O. Savile (2091), July 6, 1951. DAOM 29444, St. Anthony, Nfld. Coll. D. B. O. Savile and J. Vaillancourt, June 4, 1951.

All specimens on *Abies balsamea* (L.) Mill.

GEOGLOSSACEAE

Cudonia circinans (Pers. ex Fr.) Fr. Summa Veg. Scand. p. 348. 1849.

Leotia circinans Pers. Comm. Fung. Clav. 31. 1797.

Leotia circinans Fr. Syst. Myc. 2: 27. 1822.

This species is known from a wide range in Europe and North America with a generally northern distribution. It has been well described and illustrated by Durand (1908) who reported it as occurring from Newfoundland to Alberta. The present records extend the range slightly.

Specimens examined: DAOM 26013, Dawson, Yukon. Coll. J. A. Calder and L. G. Billard (3916), July 24, 1949. DAOM 26021, Mayo, Yukon. Coll. J. A. Calder and L. G. Billard (4122), July 28, 1949.

HELVELLACEAE

Helvella crispa (Scop.) Fr. Syst. Myc. 2: 14. 1822.

Phallus crispus Scop. Fl. Carn. 2: 475. 1772. Specimen examined: DAOM 25986, Mayo, Yukon. Coll. J. A. Calder, L. G. Billard, J. M. Gillett and D. Mitchell (4112), Aug. 1, 1949. **Helvella elastica** Bull. ex. Fr. Syst. Myc. 2: 21. 1822.

Specimen examined: DAOM 26129, Goose Bay, Labrador. Coll. J. M. Gillett and W. I. Findlay (5677), August 10, 1950.

Helvella lacunosa Afz. ex Fr. Syst. Myc. 2: 15. 1822.

Helvella mitra L. Sp. Pl. 1180. 1753.

Specimen examined: DAOM 26124, Fort Smith, N. W. T. Coll. C. Loan (150), Aug. 8, 1950.

All three of the *Helvella* species listed above are common and widely distributed. However, as far as is known these records constitute a northward extension of the range. *H. elastica* is distinguished by the long, slender, smooth stem whereas in both of the other species the stem is deeply fluted with prominent ridges running almost the entire length of the stem. In *H. lacunosa* both the stem and pileus are smoky to nearly black whereas in *H. crispa* they are white to cream or yellowish.

Morchella angusticeps Peck, Ann. Rep. N.Y. St. Mus. 32: 44. 1879.

Phalloboletus angusticeps Kuntze, Rev. Gen. Pl. 2: 865. 1891.

The usual concept of *M. angusticeps* is a fruiting body with a relatively narrow, elongated cap, a yellowish-brown, somewhat furfuraceous stipe, and yellowish brown pits with the ribs smoky-brown to blackish on the edges, although the original description by Peck (1879) does not mention the dark edges of the ribs. Through the kindness of Mr. S. J. Hughes we are informed that Peck's type collection contains fruit bodies with dark ribs as well as some lacking the dark edges.

The species is not very common around Ottawa, but from our field observations in this area we are of the opinion that the young fruit bodies do not have dark edges to the ribs, but that the darkening develops as the fruit body matures.

Accordingly, specimens both with and without the dark edges to the ribs have been referred to this species. The possibility of the identity of *M. angusticeps* and *M. conica* has been discussed by Groves and Hoare (1953).

In the Ottawa District, *M. esculenta* is much more common than *M. angusticeps* and it is interesting that, of the twelve collections of morels received from the north, all should prove to be *M. angusticeps*.

The record of *M. conica* from Alaska listed by Cash (1953) is probably this species. Specimens examined: DAOM 20701, Goose

Bay, Labrador. Coll. H. A. Senn (3374), June 9, 1948. DAOM 20702, Churchill, Man. Coll. J. M. Gillett (2034), July 8, 1948. DAOM 24048, Whitehorse, Yukon. Coll. J. M. Gillett (3521), June 27, 1949. DAOM 25193, N. Alberta, near Ft. Smith, N.W.T. Coll. W. Cody and C. Loan (3679), May 31, 1950. DAOM 25196, Gillam, Man. Coll. W. B. Schofield (959), June 13, 1950. DAOM 25197, Ft. Smith, N.W.T. Coll. W. Cody and C. Loan (3921), June 21, 1950. DAOM 25981, Dawson City, Yukon. Coll. W. Judd, June 20, 1949. DAOM 26004, Dawson City, Yukon. Coll. W. Judd, June 12, 1949. DAOM 26014, West Dawson, Yukon. Coll. W. Judd, 1949. DAOM 26304, Fort Churchill, Man. Coll. W. G. Dore, July 2, 1949. DAOM 26305, Moose Factory, Ont. Coll. D. B. O. Savile (91), June 10, 1949. DAOM 28366, St. Anthony, Nfld. Coll. D. B. O. Savile and J. Vaillancourt (1725), June 3, 1951.

PEZIZACEAE

Aleuria aurantia (Pers. ex Fr.) Fckl. Symb. Myc. 325. 1870.

Peziza aurantia Pers. Obs. Myc. 2: 76. 1797.

Peziza aurantia Fr. Syst. Myc. 2: 49. 1822.

Otidea aurantia Mass. Brit. Fung. Fl. 4: 448. 1895.

This species can be readily recognized by its bright orange colour and fairly large size, reaching several centimeters in diameter. The spores are sculptured in a reticulate manner. It is one of the commonest and most widely distributed of the larger Discomycetes, but does not appear to have been reported previously as far north in North America as the Yukon.

Specimen examined: DAOM 26016, Dawson, Yukon. Coll. J. A. Calder and L. G. Billard (3433), July 1, 1949.

Geopyxis bronca (Peck) Seav. N. Amer. Cup-Fungi. Operculates p. 213. 1928.

Peziza bronca Peck, Ann. Rep. N.Y. St. Mus. 29: 54. 1878.

Pustularia bronca Kanouse, Mycologia 42: 497. 1950.

This species has been well described and illustrated by Kanouse (1950). She has pointed out that Seaver (1928) confused this species with *Aleuria humicola* Boud. and that his description was based on a combination of the descriptions by Peck and Boudier of the two different fungi. However, Seaver's name must be considered to be based on Peck's type and since *Pustularia* Fckl. is a later homonym of *Pustularia* Roussel, the name *Geopyxis bronca* is valid.

Specimens examined: DAOM 25832, Gillam, Man. Coll. W. B. Schofield (1291), July 30, 1950. DAOM 28364, St. Anthony, Nfld. Coll. D. B. O. Savile (2542), July 27, 1951. DAOM 28365, St. Anthony, Nfld. Coll. D. B. O. Savile and J. Vaillancourt (2388), July 18, 1951.

Geopyxis cupularis (L. ex Fr.) Sacc. Syll. Fung. 8: 72. 1889.

Peziza cupularis L. Sp. Pl. 1181. 1753.

Peziza cupularis Fr. Syst. Myc. 2: 62. 1822.

Pustularia cupularis Fckl. Symb. Myc. 328. 1870.

Aleuria cupularis Gill. Champ. Fr. Discom. 39. 1879.

Among the northern collections there were two species that appeared to belong in the genus *Geopyxis*. One had spores 12-15 x 7-9 μ and evidently grew in sandy areas. Two of the collections were closely associated with spruce needles. The second species had larger spores 15-20 x 8-10 μ and was growing among mosses.

According to Seaver (1928) *G. cupularis* is found on burned rocky areas and has spores 18 x 9-10 μ . *G. vulcanalis* occurs among mosses and has spores 14-18 x 8-10 μ . From this it would appear that there was little difference in the spore size, but examination of other herbarium specimens of *G. cupularis* which had been collected in the more typical habitat of burned areas, revealed that they also possessed the smaller spores.

Therefore, it was decided to refer the specimens with the small spores to *G. cupularis* and the moss-inhabiting specimens with the larger spores to *G. vulcanalis*.

Specimens examined: DAOM 20763, Fort Churchill, Man. Coll. J. M. Gillett (2076), July 13, 1948. DAOM 26019, Yellowknife, N.W.T. Coll. W. Cody and J. B. McCause (2160), June 18, 1949.

Geopyxis vulcanalis (Peck) Sacc. Syll. Fung. 8: 65. 1889.

Peziza vulcanalis Peck, Rep. U.S. Geol. Surv. Terr. 6: 792. 1873.

This species is discussed under *G. cupularis*. Specimens examined: DAOM 25831, Gillam, Man. Coll. W. B. Schofield, (1378), Aug. 8, 1950. DAOM 26146, Fort Smith, N.W.T. Coll. C. Loan (157), Aug. 8, 1950.

Humarina leucoloma (Hedw. ex Fr.) Seaver, N. Amer. Cup-Fungi. Operculates p. 129. 1928.

Octospora leucoloma Hedw. Descr. 2: 13. 1788.

Peziza leucoloma Fr. Syst. Myc. 2: 71. 1822.

Aleuria leucoloma Gill. Champ. Fr. Discom. 56. 1879.

Humaria leucoloma Quel. Ench. Fung. 289. 1886.

Neottiella leucoloma Mass. Brit. Fung. Fl. 4: 374. 1895.

Linder (1947) has reported this species from Pangnirtung, Baffin Island, and considered that it was the first record from the far north. The collection below appeared to be this species although the spores were slightly larger than stated by Seaver (1928). He gave the dimensions as 18-24 x 12-15 μ and in this specimen they were 20-27 x 14-16 (-18) μ . The difference is not considered to be significant.

Specimen examined: DAOM 25828, Gillam, Man. Coll. W. B. Schofield (1142), July 14, 1950.

Patella scutellata (L. ex Fr.) Morg. Journ. Myc. 8: 187. 1902.

Peziza scutellata L. Sp. Pl. 1181. 1753.

Peziza scutellata Fr. Syst. Myc. 2: 85. 1822.

Humaria scutellata Fckl. Symb. Myc. 321. 1870.

Lachnea scutellata Gill. Champ. Fr. Discom. 75. 1879.

Humariella scutellata Schröt. Krypt.-Fl. Schles. 3, 2: 37. 1893.

Ciliaria scutellata Boud. Hist. Classif. Discom. d'Eur. 61. 1907.

This species is very common on rotten wood and sometimes on soil, and has a wide distribution. The apothecia are bright red, fading to yellowish or nearly white when dried, and are clothed with brown, bristle-like hairs. Of the specimens examined, two were said to be on the ground, one on the ground near buried wood, and two were definitely on wood.

Specimens examined: DAOM 28367, St. Anthony, Nfld. Coll. D. B. O. Savile and J. Vaillancourt (2387), July 18, 1951. DAOM 26123, Goose Bay, Labrador. Coll. W. I. Findlay (5895), Aug. 26, 1950. DAOM 27739, Icy Arm, Clyde Fiord, Baffin Island. Coll. V. C. Wynne-Edwards, Aug. 5, 1950. DAOM 25833, Gillam, Man. Coll. W. B. Schofield (1068), June 16, 1948. DAOM 26120, Fort Smith, N.W.T. Coll. C. Loan (156), Aug. 8, 1950.

Paxina corium (Weberb.) Seaver, N. Amer. Cup-Fungi. Operculates p. 208. 1928.

Peziza corium Weberb. Pilze Norddeutsch. pl. 3, f. 7. 1873.

Aleuria corium Gill. Champ. Fr. Discom. 39. 1879.

Lachnea corium Phill. Brit. Disc. 204. 1887.
Macropodia corium Sacc. Syll. Fung. 8: 159. 1889.

Fuckelina corium Kuntze, Rev. Gen. Pl. 2: 852. 1891.

Sarcoscypha corium Schröt. Krypt.-Fl. Schles. 3, 2: 59. 1893.

Cyathipodia corium Boud. Hist. Classif. Discom. d'Eur. 39, 1907.

Leptopodia corium Boud. Icon. Myc. 6: 1, 6. 1909.

It is apparent from the list of synonyms above that this is a difficult fungus to place with regard to its generic position. The genus adopted by Seaver (1928) has been used here, although it is possible that the earlier name *Acetabula* Fckl. may stand.

The apothecia are black with short stipes, tough in consistency, drying very hard, somewhat hairy on the outside.

Linder (1947) referred to records of this species from Greenland, Iceland, and northern Sweden, and Bisby *et al* (1938) reported it from Manitoba. The Calder and Billard specimen is the only Canadian record in the herbarium at Ottawa.

Specimen examined: DAOM 25983, Dawson, Yukon. Coll. J. A. Calder and L. G. Billard (3277), June 24, 1949.

Paxina sulcata (Pers. ex Fr.) Kuntze, Rev. Gen. Pl. 2: 864. 1891.

Peziza sulcata Pers. Syn. Fung. 643. 1801.

Peziza sulcata Fr. Syst. Myc. 2: 44. 1822.

Acetabula sulcata Fckl. Symb. Myc. 330. 1870.

In this species the apothecium is more brown than black and the stem is deeply furrowed and whitish to yellowish, much paler than the outside of the apothecium. As far as known it has not previously been reported from the far north.

Specimen examined: DAOM 20767, Southampton Island. Coll. W. Cody (1890), Aug. 6, 1948.

Peziza badia Pers. ex. Fr. Syst. Myc. 2: 46. 1822.

Peziza badia Pers. Obs. Myc. 2: 78. 1799.

Scodellina badia S. F. Gray, Nat. Arr. Brit. Pl. 1: 669. 1821.

Plicaria badia Fckl. Symb. Myc. 327. 1869.

Aleuria badia Gill. Champ. Fr. Discom. 43. 1879.

Galactinia badia Boud. Hist. Classif. Discom. d'Eur. 48. 1907.

This is one of the larger species of *Peziza* with the apothecium tan to dark brown with

reddish or purplish pustules, a dark brown or slightly olive-brown hymenium and rough-walled spores. It is widely distributed but, as far as is known, this is believed to constitute a northward extension of the range. Specimen examined: DAOM 25017, Goose Bay, Labrador. Coll. J. M. Gillett (5681), Aug. 9, 1950. DAOM 26115, Ft. Fitzgerald, Alberta. Coll. W. Cody and C. Loan (4720), July 24, 1950.

Peziza repanda Pers. ex Fr. Syst. Myc. 2: 51. 1822.

Peziza repanda Pers. Myc. Eur. 1: 231. 1822.
Aleuria repanda Gill. Champ. Fr. Discom. 43. 1879.

Discina repanda Sacc. Syll. Fung. 8: 100. 1889.

Plicaria repanda Rehm. Rab. Kr.-Fl. I, 3: 1007. 1896.

This is a rather large species usually associated with rotten wood. It is whitish externally with a brown hymenium and has smooth spores. It is one of the commonest and most frequently collected species of the genus, but this is believed to constitute a northward extension of the range for this species also.

Specimens examined: DAOM 26006, Whitehorse, Yukon. Coll. J. M. Gillett (4452), Aug. 12, 1949. DAOM 26007, Dawson, Yukon. Coll. J. A. Calder and L. G. Billard (3378), June 29, 1949.

Plectania protracta (Fr.) Gelin, Königl. Norske Vidensk. Selsk. 10: 194. 1937.

Peziza protracta Fr. Nov. Symb. Myc. 230. 1851.

Sarcoscypha protracta Sacc. Syll. Fung. 8: 155. 1889.

Microstoma hiemalis Nees and Bernst. Bot. Zeit. 10: 208. 1852.

Plectania hiemalis Seaver, N. Amer. Cup-Fungi. Operculates. p. 193. 1928.

Sarcoscypha alpina Ell. and Ev. Bull. Torr. Club 24: 281. 1897.

The distribution of this fungus may be predominantly northern. Seaver (1928) stated that he had seen only one North American specimen, but Bisby *et al* (1938) reported it as common in Manitoba. It has been discussed and illustrated by Buller (1934). It is a striking species with stalked hairy apothecia and scarlet discs.

Specimens examined: DAOM 25880, Gillam, Manitoba. Coll. W. B. Schofield (839), May 29, 1950. DAOM 26018, West Dawson, Yukon.

Coll. J. A. Calder and L. G. Billard (3077), June 15, 1949. DAOM 26020, Whitehorse, Yukon. Coll. J. M. Gillett and D. A. Mitchell (3433), June 21, 1949. DAOM 27755, Hay R., N.W.T. Coll. W. H. Lewis (227), June 3, 1951. DAOM 27866, Hay R., N.W.T. Coll. W. H. Lewis (273), June 11, 1951.

Pseudoplectania melæna (Fr.) Sacc. Syll. Fung. 8: 165. 1889.

Peziza melaena Fr. Syst. Myc. 2: 60. 1822.

Melascypha melaena Boud. Hist. Classif. Discom. d'Eur. 56. 1907.

Peziza vogesiaca Pers. Moug. & Nestl. Stirpes Crypt. n. 584. 1818.

Pseudoplectania vogesiaca Seav. Mycologia 5: 300. 1913.

The collection below is the only Canadian record in the herbarium at Ottawa but the fungus, under the name *P. vogesiaca* (Pers.) Seav., has been reported from Manitoba by Bisby *et al* (1938) and from Nova Scotia by Wehmeyer (1950). Under the International Rules the correct name is *P. melaena* (Fr.) Sacc.

The apothecia are black, stipitate, about 2-3 cm. in diameter, slightly hairy, and of a rather tough consistency. The spores are globose.

Specimen examined: DAOM 28368, St. Anthony, Nfld. Coll. D. B. O. Savile and J. Vailancourt (1638), May 27, 1950.

Scodellina auricula (Schaeff.) Seaver, N. Amer. Cup-Fungi. Operculates. p. 185. 1928.

Elvela auricula Schaeff. Fung. Bavar. Ind. 103. 1774.

Peziza auricula Cooke, Mycographia 124. 1876.

Aleuria auricula Gill. Champ. Fr. Discom. 40. 1879.

Otidea auricula Rehm, Hedw. 22: 34. 1883.

Wynnella auricula Boud. Hist. Classif. Discom. d'Eur. 51. 1907.

The North American species of this genus have been reviewed by Kanouse (1949) under the name *Otidea*, but it would seem that this name must be regarded as a later synonym of *Scodellina*. According to Kanouse (1949) this species with a brown excipulum has been confused with another species with a whitish excipulum. This latter species may be *Otidea neglecta* Massee.

In the specimens examined, the excipulum is brown and they have the straight, slender paraphyses and large spores as described for *S. auricula*.

Specimens examined: DAOM 26121, Fort Smith, N.W.T. Coll. Loan (120), Aug. 6, 1950. DAOM 25830, Gillam, Manitoba. Coll. W. B. Schofield (1379), Aug. 8, 1950.

Sphaerospora trechispora (Berk. & Br.) Sacc. Syll. Fung. 8: 188. 1889.

Peziza trechispora Berk. & Br. Ann. Mag. Nat. Hist. 18: 77. 1846.

Lachnea trechispora Gill. Champ. Fr. Discom. 77. 1879.

Sphaerosporula trechispora Kuntze, Rev. Gen. Pl. 3, 3: 530. 1898.

Ciliaria trechispora Boud. Hist. Classif. Discom. d'Eur. 62. 1907.

The distribution of this species in North America was given as New York to Colorado by Seaver (1928), and Linder (1947) reported two collections from Baffin Island. There are no other specimens in the herbarium at Ottawa and, as far as is known, no other Canadian records.

The fungus occurs among mosses on the ground and has bright red apothecia about a centimeter or less in diameter, and covered with dark brown, bristle-like hairs. The spores are globose, 20-22 μ in diameter and with wart-like roughenings on the surface.

Specimen examined: DAOM 23415, Southampton Island. Coll. W. Cody (1603), July 27, 1948.

Urnula craterium (Schw.) Fr. Nova Acta Soc. Sci. Upsal. III, 1: 122. 1851.

Peziza craterium Schw. Syn. Fung. Carol. p. 117. 1822.

Cenangium craterium Fr. Elench. Fung. 2: 21. 1828.

Dermea craterium Schw. Syn. Fung. Amer. bor. p. 237. 1832.

Geopyxis craterium Rehm, Rab. Kr.-Fl. I, 3: 974. 1896.

The above is not intended as the complete list of synonyms for this interesting fungus. The black, more or less stalked apothecia arise from buried wood and are to be found in the spring. In the specimen examined, the apothecia had been detached from the substrate and it was not possible to determine the kind of wood on which they had been growing.

Specimen examined: DAOM 25825, Gillam, Man. Coll. W. B. Schofield (844), May 29, 1950.

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NOTES ON THE BIRDS OF JASPER NATIONAL PARK, ALBERTA¹

A. W. F. BANFIELD

Canadian Wildlife Service, Banff, Alberta.

JASPER National Park, comprising an area of 4,200 square miles, lies along the eastern slope of the Rocky Mountains, north of Banff National Park. It is of considerable importance in Canadian natural history because of the work of such early naturalists as Drummond, Loring, and Hollister. Recent papers dealing with the birds of the Rocky Mountains of Alberta have been published by Clarke and Cowan (1945) and Soper (1947).

The author first visited Jasper Park during the month of June, 1946, in the company of Dr. I. McT. Cowan. Since August, 1950, several investigations have been undertaken in the park at all seasons. The most recent long investigation occupied the month of May, 1952.

This paper is not intended to present a list of the birds of the park, but only to record unusual bird observations. The majority of the observations were made in the lower Athabasca Valley from Jasper to the east gate.

The lower Athabasca Valley lies at an elevation of about 3,500 feet. The mountains in the park range in altitude up to about 12,300 feet. Timber-line is at an elevation of approximately 7,000 feet. Below this altitude is the extensive subalpine forest and above it are extensive tracts of alpine tundra.

The avian fauna of the aspen parkland ecotone north of the prairies strongly influences the bird life of the lower Athabasca Valley. The presence of such species as sharp-tailed grouse, black tern, mourning dove, eastern phoebe, Cape May warbler, bronzed grackle, Leconte's sparrow, clay-coloured and white-throated sparrows, are indications of this influence. The relatively low elevation, and the presence of a continuous forest eastwards are probably important factors in this connection.

ANNOTATED LIST

Western Grebe. *Aechmophorus occidentalis* (Lawrence).

Three western grebes were seen on Lake Beauvert on October 5, 1950, and again on October 19, 1952. They are probably regular autumn migrants.

Whistling Swan. *Olor columbianus* (Ord).

Three swans were observed at Pocatontas on May 30, 1951.

White-winged Scoter. *Melanitta deglandi* (Bonaparte).

An infrequent migrant in the mountains; two were observed on Pyramid Lake on May 13, 1952.

Surf Scoter. *Melanitta perspicillata* (Linnaeus).

Judging by the following observations, the surf scoter was a common migrant during May, 1952: 33 on Pyramid Lake, May 13; 10 on Leach Lake, May 15; 5 on the same lake, May 28; and 15 on May 30.

Ruddy Duck. *Oxyura jamaicensis* (Gmelin).

A single drake was seen on Lake Beauvert on October 5, 1950.

Bald Eagle. *Haliaeetus leucocephalus* (Linnaeus).

An occupied nest in a large spruce on an island in the Athabasca River was examined by Cowan and Banfield on June 5, 1946. In May, 1952, the nest was again occupied. An adult eagle was observed at Jasper on February 28, 1951.

Sharp-tailed Grouse. *Pedioecetes phasianellus* (Linnaeus).

One sharp-tailed grouse was seen at Pyramid Lake on December 9, 1951, and three at Snaring on December 11, 1951. It is noteworthy that at the same time the population of these grouse was high in the foothills east of the park.

Golden Plover. *Pluvialis dominica* (Muller).

A single plover was seen at Medicine Lake on October 5, 1950.

Lesser Yellow-legs. *Totanus flavipes* (Gmelin).

Three lesser yellow-legs were observed by D. A. Munro and Banfield at Talbot Lake on May 17, 1952.

California Gull. *Larus californicus* Lawrence.

Four California gulls were observed at Pyramid Lake on October 9, 1950. An injured juvenile was collected by Warden George Camp at Athabasca Falls on October 17, 1952. The specimen was identified by W. Earl Godfrey of the National Museum of Canada.

¹) Received for publication February 20, 1953.

Short-billed Gull. *Larus canus* Linnaeus.

A single short-billed gull was observed at close range on the shore of a small lake on Buffalo Prairie on May 27, 1951.

Black Tern. *Chlidonias niger* (Linnaeus).

Two were observed in the marsh at Poca-hontas on June 3, 1946.

Mourning Dove. *Zenaidura macroura* (Linnaeus).

A single dove was seen at Jasper on May 15, 1952.

Short-eared Owl. *Asio flammeus* (Pontoppidan).

Two were observed on alpine tundra at Signal Mountain, June 19, 1946; and on Sunwapta Pass, August 30, 1952. One was seen at the Snaring River on December 11, 1951.

Black Swift. *Cypseloides niger* (Gmelin).

A group of about 25 black swifts were observed swooping low over the Athabasca River near Whistlers Creek on August 27, 1952. They were accompanied by a nighthawk *Chordeiles minor*. The weather was cloudy with an approaching storm.

Lewis's Woodpecker. *Asyndesmus lewisi* Gray.

In June, 1946, a Lewis's woodpecker was observed near Devona. On June 19 the nest was discovered by Cowan in an exposed Douglas fir (*Pseudotsuga taxifolia*) stub. The nest containing five eggs and both adults were collected by Cowan.

Eastern Phoebe. *Sayornis phoebe* (Latham).

A pair of phoebes were seen at Miette on June 10, 1946. A second pair were seen at Whistlers Creek on May 25, 1952.

Starling. *Sturnus vulgaris* Linnaeus.

Starlings were first observed at Jasper on May 10, 1952. On May 21 a nest was discovered in a hole in an aspen (*Populus tremuloides*) at Colin Creek. The hole had been made by a flicker.

Cape May Warbler. *Dendroica tigrina* (Gmelin).

A singing male was identified at Miette on June 3, 1946.

Bronzed Grackle. *Quiscalus quiscula versicolor* Vieillot.

A bronzed grackle was seen on the shore of the Athabasca River on June 5, 1946.

Evening Grosbeak. *Hesperiphona vespertina* (Cooper).

A pair was observed at Jasper on May 30, 1951.

Rosy Finch. *Leucosticte tephrocotis* (Swainson).

Although rosy finches are common summer breeding birds of the alpine tundra, the observation of a flock of 25 at the tunnel on December 6, 1951, seems noteworthy.

Leconte's Sparrow. *Passerherbulus caudacutus* (Latham).

A Leconte's sparrow was first identified by song in a marsh at Poca-hontas on June 3, 1946. It was later flushed and collected by Cowan.

Clay-coloured Sparrow. *Spizella pallida* (Swainson).

First observed at Devona on June 19, 1946. A singing male was identified at Poca-hontas on May 23, 1952.

White-throated Sparrow. *Zonotrichia albicollis* (Gmelin).

Two white-throated sparrows were identified at the Moosehorn River on May 29, 1951. Three were observed at Pyramid Lake on May 30, 1952.

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THE EFFECT OF D.D.T. AND OIL ON MUSKRATS ^{1, 2}

L. E. WRAGG

*Madison, Wisconsin.***Introduction**

IN 1946, the Ontario Department of Lands and Forests initiated a study of muskrat numbers in the 800-acre Dundas Marsh, part of a game preserve near Hamilton, Ont. In this marsh in 1944, game overseer G. Beattie and other interested naturalists estimated the muskrat population at 5,000. In August, 1945, under supervision of the Hamilton Department of Health, a 3% solution of D.D.T. in fuel oil and kerosene was sprayed at one gallon per acre over the southern border of the marsh and nearby ravines to control mosquitoes. The following winter interested naturalists saw fewer than 30 houses in the marsh.

The popular explanation of this decrease was expressed by an editorial article which appeared in the *Hamilton Spectator* in the summer of 1946. "...Parks Board officials stated today it had been brought to their attention that the spray was killing the musk-

rats in the marsh. For years the marsh has been the breeding grounds for muskrats in this district. After breeding in the marsh they journey up the streams into a wide area around Hamilton and provide farmers and trappers with a fairly lucrative source of income. Their numbers however are reported decreasing due to death from the D.D.T. sprayed on the marsh..."

Observations

A four month study of the area in 1946 showed the habitat apparently excellent with no reason to believe food shortage, drought, pollution, severe winter, predation, or migration was responsible for the decline that had occurred.

D.D.T. apparently had no effect. Less than 1/5 the marsh was sprayed, and this only once in 1945. The following year it was sprayed three times but the muskrat population increased. Effect on other animals was negligible — only six small sunfish were found dead in about 12 acres after a spraying in

1) From an M.A. thesis submitted to the Department of Zoology, University of Toronto.

2) Received for publication October 27, 1952.

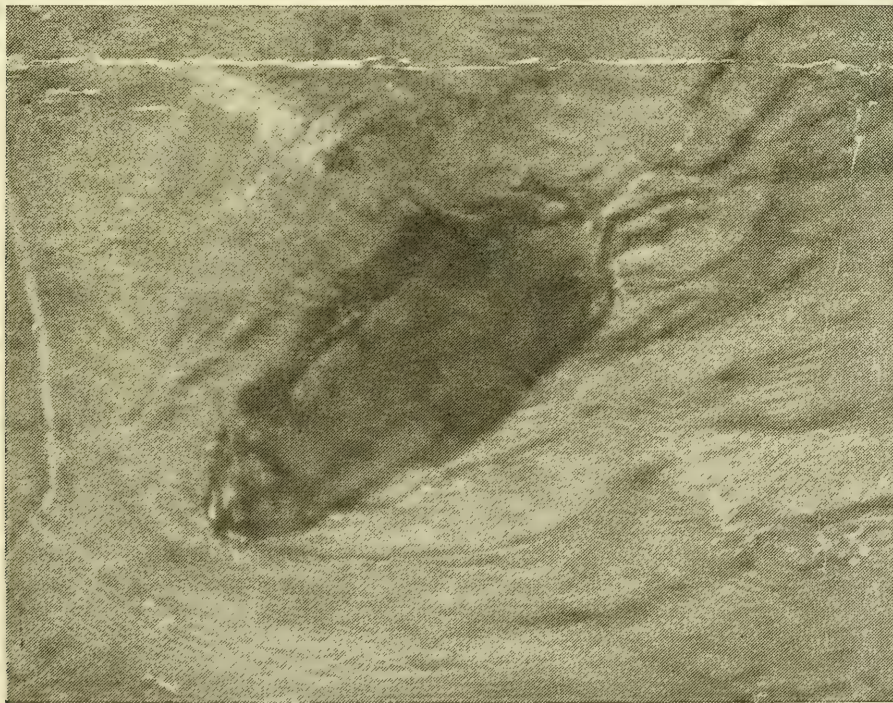


Fig. 1. Normal muskrat floating.

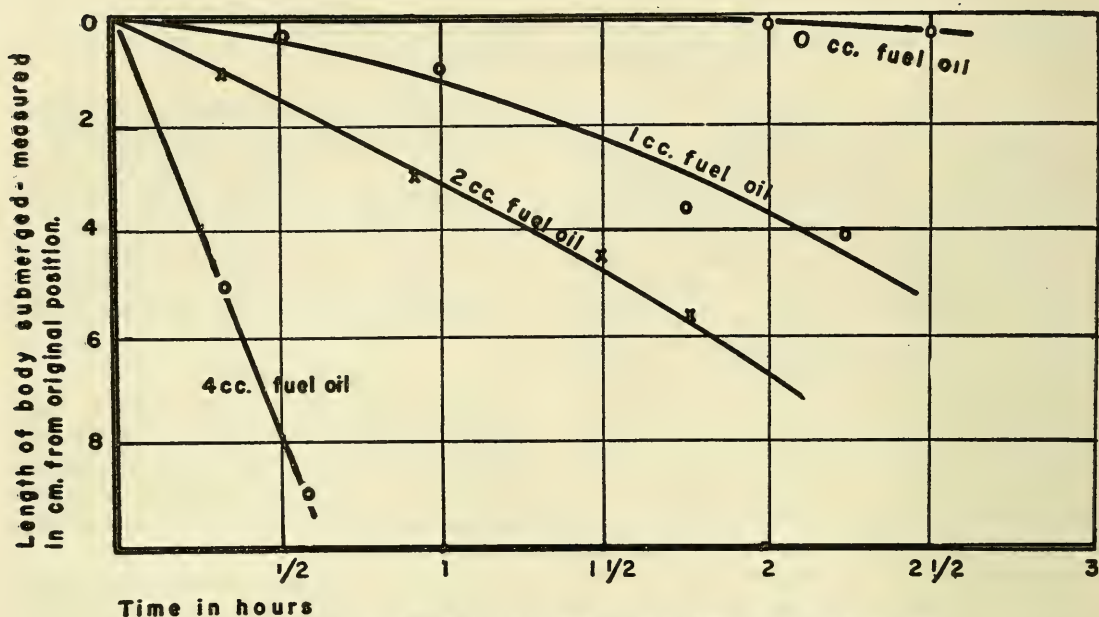


Fig. 2 Sinking rate of muskrats in water plus fuel oil.
(water surface - 22 in. X 44 in.)

August although tadpoles and frogs were scarce all summer. Muskrat populations in other marshes (Rondeau Provincial Park for example) sprayed with stronger solutions maintained high numbers. Experimental captive animals whose food was sprayed with D.D.T. solutions gave inconclusive results owing to their deaths complicated by infection and heavy parasitization, and deaths of controls.

Oil used as a solvent was checked for harmful effects. Muskrats were placed in a tank of water (depth — 11 in.; surface — 22 x 44 in.; temperature — 14 to 16°C.) and small amounts of fuel oil added. A different animal was used in a thoroughly cleaned tank for each of the following tests.

a) Clean Water: After two and one half hours the animal was floating quietly or swimming leisurely in the tank. It was floating in normal position, the entire dorsal surface breaking water (see fig. 1) and did not appear anxious to leave when a platform was introduced.

b) One c.c. fuel oil added: After two hours the whole animal sank 1 cm., and the rear 4 cm. was under-water. Forty-five seconds

after a platform was put in the tank, the muskrat climbed from the water and began rubbing its wet belly fur.

c) Two cc. fuel oil added: After 1½ hr. the animal was 1½ cm. lower in the water, the dorsal surface submerged almost to the shoulder. The animal appeared relatively calm, but constantly explored the aquarium and climbed at the walls. When removed, the bedraggled muskrat showed none of its usual pugnacity but concentrated upon rubbing its fur which had become soaked.

d) Four cc. fuel oil added: As long as the platform was present the muskrat would leave it only when frightened or pushed. After being in the water 20 min. it manifested distress by exploring the water line, climbing at the wall, walking on the bottom with head held high, and making frantic dives and climbs. After 40 min. only the head broke water surface, the rest of the body was soaked and must have been cold because the feet were trembling. At this point the platform was replaced and the animal immediately climbed upon it but for 20 min. kept falling back into the water or against the wall of the aquarium, apparently suffering from exposure. A reddish irritation appeared around the eyes.

These results are plotted in fig. 2.

To test duration of wetting effect, animal c), subjected to the 2cc. fuel oil on water, was kept in a dry pen for four days and then put in a tank of clean water. In two hours its fur had become wet and the animal was sinking.

Conclusion

Fuel oil has a persistent and cumulative wetting effect on muskrats. The results of these tests suggest that the oil in which D.D.T. is sprayed on marshes in which muskrats are living is likely to have a more deleterious effect on the animals than the D.D.T.

NOTES ON DOWNY PLUMAGES OF LOONS (GAVIIDAE) ¹

A. L. RAND

Chicago Natural History Museum

IN 1944 Dr. Louis B. Bishop described the first downy plumage of the four species of loons, all from specimens in the Bishop collection, now part of the Chicago Natural History Museum collection. Mr. L. L. Snyder of Royal Ontario Museum has written me pointing out some surprising conclusions from this work: notably that the downy young of *Gavia immer* and *G. arctica* closely resemble each other as do *G. adamsii* and *G. stellata*. One would have expected that *G. immer* and *G. adamsii*, representative species, certainly members of the same super-species if not actually conspecific, would have been most alike. Consequently I have gone over all the material in the Chicago Natural History Museum.

Apparently some misidentification affected Bishop's work and the birds described as *G. immer elasson* from Churchill are actually *G. arctica pacifica*. Another point that Bishop made was that patterns of fine dark lines were present in the plumages of several species. These lines, present in the specimens, seem not to be part of the pattern but rather to be the results of folds in the skin pushing the down together locally and thus giving darker lines and areas.

Loons have two sets of down: the first coat in which they hatch, and a second set of down that pushes out the first and carries it on its tips, later to be pushed out by the feathers of the first winter plumage. The present notes deal only with the first set of down. It is sometimes said that the downy loons become paler as they become larger. This could result from fading; from the mechanical spreading of the same amount of down over a larger area; and from a paler color of the second down coat. This is not apparent in the scanty material of small

downies available to me. In *G. stellata*, of which we have four downies with more size variation than in our series of any other species the largest is about as dark as the smallest.

Though the downy young of loons have been described a number of times it seems advisable to re-describe the present material. All young loons are fairly similar, and due to the very similarity, I feel a generally-worded description, plus a comparison with each other is more useful than a detailed description and comparison with some color standard.

Gavia immer (Brunnich). Common Loon.

We have two downy young, probably not more than a week or so old. One has an exposed culmen of 13, the other 15 mm. One is from Lake Winnipegosis, Manitoba, the other from Wood Co., Wisconsin.

The Manitoba downy is brownish black, nearly black, above, with throat, upper breast and flanks somewhat greyer. The lower breast and belly is white, strongly tinged yellow (normal?) and this area is margined with grey.

The Wisconsin young, slightly larger, is similar but somewhat browner above, and with the lower breast and belly plain white, barely tinged yellow posteriorly; the grey outlining the white area is indistinct.

The bills of both, whitish egg tooth still in place, are stout; in color blackish horn, paler toward the tip (dried skin).

Bent, 1919, p. 51; Witherby, 1940, p. 116; and Forbush, 1925, p. 17, describe the downy young much as the above, but do not mention any yellow tinge to the white underparts such as our one specimen shows. Bishop's (1944, p. 182) description of *G. immer elasson* is of *G. a. pacifica*.

¹ Received for publication February 26, 1953.

Gavia adamsii (Gray). **Yellow-billed Loon.**

We have two downy young from near Barrow Alaska (Chipp River) that Bishop (1944, p. 182) described. Presumably they are less than a week old. Their exposed culmens measure 13 and 14 mm.

Their upperparts are dark brownish, considerably paler than the paler of the two *G. immer* chicks; the throat, upper breast, and flanks paler than the back; the lower breast and abdomen are covered with a white area, sharply defined against the surrounding dark, and with a faint grey margin, less conspicuous than in *G. immer*.

The bill, each with the whitish egg tooth attached, is stout like that of *G. immer*; in color white, with the area about the nostrils, and the base of the lower mandible blackish (dried skin).

The pattern of fine lines described by Bishop (1944, p. 182) seems to be due to folds in the skin.

Bent's (1919, p. 62) description of the downy young agrees with the above in giving the general color as very light (presumably compared with *G. immer*, though he gives the underparts only as "tilleul buff" or nearly white on the belly, and makes no mention of the conspicuous bill color.

Gavia stellata (Pontoppidan). **Red-throated Loon.**

We have four downy young from Barrow and Stewart, Alaska. The smallest is probably less than a week old; their exposed culmens measure: 11, 13, 15, 18 mm.

The upperparts are blackish brown to greyish brown, varying individually, averaging between that of *G. immer* and *G. adamsii*. The largest bird is little paler than the smallest. The throat, upper breast, and flanks are like upperparts but paler; the lower breast and abdomen are dull grey in all four specimens, the area sharply defined from the surrounding darker down.

Their bills are slender, each with whitish egg tooth attached; in color dark horn slightly paler at the tip of upper mandible, and whitish on the tip of the lower mandible.

Bent (1919, p. 76) and Forbush (1925, p. 28) describe the downy young as dark brown above, shading to drab below. Bishop's (1944, p. 182) mention of fine lines seems due to mistaking the results of folds in the skin for actual pattern. Sutton (1932, p. 23) says the soft parts of the downy young of this bird are: eye dull brown; bill and feet dusky,

darker than in *G. a. pacifica*; and the feet lacking the greenish tinge of the latter.

Gavia arctica pacifica (Lawrence). **Pacific Loon.**

We have three young from Churchill, one labeled by A. M. Heydweiller as about two days old (exposed culmen 10 mm.) and two collected by A. L. Wilk from one nest, of about the same age (exposed culmen 9, 11 mm.).

These have the upper parts of the body dusky or brownish grey, greyer than the other species; top of head and neck considerably paler grey like the rest of the head, neck, upper breast, and flanks; lower breast and belly varies from grey tinged whitish to a whitish area fairly well defined from the surrounding grey down (note that this variation occurs in two nest mates).

Bill slender, whitish egg tooth attached in each case; in color dark horn with a slaty tinge, slightly paler at tip.

Bent (1919, p. 69) and Forbush (1925, p. 27) mention the paling of the color on the head. Witherby (1940, p. 122) makes no mention of the paler head in the European bird, *G. a. arctica*, and says the downy young is like that of *G. stellata*, which is not true of the American birds of these two species.

Bishop's (1944, p. 182) description of *G. immer elasson* is based on a specimen of *G. arctica pacifica*, and the pattern he described is caused by folds in the skin.

Sutton (1932, pl. XXII, fig. 5) figures the head, breast, and soft parts of the fresh downy young as paler and greyer than our specimens; the bill is grey, foot greenish grey. On page 17 he gives: eye of newly hatched young dull gray brown; bill dull blue-grey, lighter on tip.

Comparisons

Gavia immer and *G. adamsii* are very similar in having a heavy bill, in dark upperparts and a well defined white ventral area; they differ chiefly in the lighter and slightly browner down, and the white bill of *G. adamsii*.

Gavia stellata and *G. p. arctica* differ from the above two species in the more slender bill. *G. stellata* in general color is between *G. immer* and *G. adamsii* but differs from both in having the ventral area dull grey, not white.

Gavia p. arctica is the greyest of the four, and has the crown paler grey contrasting

with the back, and the belly variable, whitish to whitish tinged only.

It is interesting that in two cases the downy young characters foreshadow characters conspicuous in the adult: the pale bill of *G. adamsii* and the grey crown and nape of *G. arctica pacifica*.

It seems that the downy young of each species is moderately distinct. As to relationships of the species the downy young are all rather similar, and afford no convincing clues as to relations within the group.

Summary

The downy young of the four species of loon are described, compared with previous descriptions, and discrepancies noted. Comparisons of the downy young do not indicate intra-group relationships any more clearly than do the adults.

Literature Cited

Bent, A. C.
1919. Life histories of North American diving birds. U. S. National Museum, Bulletin 107, pp. 1-239.

Bishop, L. B.
1944. Ornithological notes from Point Barrow, Alaska. Zool. Ser. Field Mus. Nat. Hist., 29, pp. 181-190.

Forbush, E. H.
1925. Birds of Massachusetts, etc., Vol. 1, pp. 1-481, Mass. Dept. Agric.

Sutton, G. M.
1932. The Birds of Southampton Island, Mem. Carnegie Mus., Vol. 12, Part II, Sect. 2, pp. 1-275.

Witherby, H. F. et al
1940. The Handbook of British Birds, Vol. 4, pp. 1-461, Witherby, Ltd., London.

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ANNUAL MEETING OF THE
OTTAWA FIELD-NATURALISTS' CLUB, DECEMBER 3, 1953

Report of Council

Since the last Annual Meeting, there were five meetings of Council held at St. Patrick's College: December 8, 1952, with 23 members present; January 23, 1953, with 25 members present; May 20, 1953, with 13 members present; October 30, 1953, with 14 members present; and November 26, 1953, with 17 members present.

Appointments were made for 1953 as follows:

- Editor of the Canadian Field-Naturalist — Dr. H. A. Senn.
- Business Manager — Mr. W. J. Cody.
- Chairman of the Publications Committee — Dr. L. S. Russell.
- Chairman of the Excursions and Lectures Committee — Prof. W. I. Illman.
- Chairman of the Reserve Fund Committee— Mr. Hoyes Lloyd.
- Chairman of the Special Lectures Committee — Dr. L. S. Russell.
- Chairman of the Membership Committee — Miss Verna Ross.
- Chairman of the Bird Census Committee — Mr. R. D. Harris.
- Chairman of the Macoun Field Club Committee — Mr. W. K. W. Baldwin.
- Chairman of the Gatineau Park Advisory Committee — Col. W. W. Mair.

Representatives, Canadian Section, International Committee for Bird Preservation — Dr. H. F. Lewis, Mr. Hoyes Lloyd.

Report of the Publications Committee

During the period December 1, 1952 to December 1, 1953, three numbers of Volume 66 and four numbers of Volume 67 of The Canadian Field-Naturalist were published, with a total of 282 pages. Beginning with Volume 67, 1953, The Canadian Field-Naturalist was published on a quarterly basis. Papers, notes and reviews were distributed as follows:

	Papers	Notes	Reviews
Botany	11	1	3
Entomology	1	1	1
Herpetology	1	1	1
Ichthyology	4	1	
Invertebrate Zoology	1	2	
Mammalogy	4	5	4
Ornithology	11	22	11
Palaeontology	1		
Parasitology		1	
Miscellaneous			5

Thirteen maps and twenty other illustrations were used. Sale of back numbers of the Naturalist during the year amounted to \$398.90.

Report of the Excursions and Lectures Committee

Under the auspices of the committee, the Annual Dinner of the Club was held in April, Spring Excursions and Early Morning Bird Walks were conducted, and a resurvey of the vascular plants of Cunningham Island was commenced under the guidance of Mr. Herbert Groh, who had made a survey of the same area some twenty-five years ago.

The committee notes with satisfaction the joint sponsorship by Council and the National Museum of Canada, under the leadership of Dr. L. S. Russell, of a second trip, on a professional level, to study the geology of the Ottawa district.

A Members Night at the Ottawa Normal School on November 12 was arranged for by a subcommittee, and proved a very interesting evening.

The interest groups studying birds, ferns and trees have shown varying degrees of activity during the year, and it is hoped that the number of these groups might soon be increased.

Two numbers of the Newsletter have been issued, and a third is in the process of production. The committee notes with deep regret the poor health of Mrs. J. W. Groves, who has found it necessary to relinquish the arduous duties of editing the Newsletter.

Report of the Special Lectures Committee

Three Audubon Screen Tours completed the 1952-53 series:

January 30 — South to Siesta Land, by Fran Wm. Hall.

March 20 — Oddities in Nature, by Walter H. Shackleton.

April 29 — America the Beautiful, by Tom and Arlene Hadley.

The following Audubon Screen Tours of the current series complete the programme for 1953:

October 20 — Once Upon an Island, by Robert C. Hermes.

November 27 — Little Known New Jersey, by Geo. Regensburg.

Report of the Membership Committee

The following three-fold campaign was carried out: (1) Application forms were enclosed with the November-December issue of *The Canadian Field-Naturalist*, together with a note asking present members to recommend friends who might wish to become members; (2) Some 500 copies of the January-March issue of the *Naturalist* were sent to libraries

and institutions with a letter soliciting memberships; (3) Table displays featuring the work of the Macoun Field Club and of the interest groups were set up in the lobby of the Glebe Collegiate at the first three Audubon Screen Tour lectures of 1953. Although 11 new memberships were obtained by this means, it would appear that these methods are too costly in time and money, and that a new approach to increasing our outside membership is indicated.

The local membership picture, on the other hand, is as follows: With no expense to the Club and little effort on the part of the committee 32 new active members and 10 associates joined during 1953. These gains in local memberships, however, were not sufficient to offset the losses, with the result that the total local membership is lower than last year. It is suggested that our local membership problem is not one primarily of attracting new members, but of holding the members we have.

Report of the Macoun Field Club Committee

After five years of inspirational leadership, Mr. Baldwin turned over his duties to a new committee consisting of Miss M. Godwin, Miss V. Humphreys and Mr. S. Bleakney, appointed by the National Museum, and Mr. H. Groh and Mr. D.C. Maddox, appointed by the Ottawa Field-Naturalists' Club, under the chairmanship of Mr. E. L. Bousfield, appointed by both sponsoring bodies.

As in previous years, the meetings of the Macoun Field Club were held at weekly intervals in the National Museum; the Senior Group on Tuesdays after school, and the Intermediate and Junior Groups on Saturday mornings at different hours to enable each group to attend the Saturday morning performances in the Children's Series of the National Museum Lecture Programme. The Senior Group numbered 22 active members, headed by Ruth Mills and a committee of four. Similar committees acted for the Intermediate Group of 36 under the chairmanship of Nette Porsild, and for the Junior Group of 34 under Peter Symons.

The winter programme for each group consisted on ten indoor meetings and two field hikes, one to the farm of Mrs. Frank Ryan, and the other to Taylor's Hill. In the spring, four field trips were made to such interesting collecting sites as Rockcliffe Park, Billing's Bridge, Tunney's Pasture and the Champlain Bridge. The autumn programme

was made up of five indoor meetings and three field trips.

and by a growing interest of the members themselves in editing and managing their Club magazine.

There were three special events during the year. In April the committees of each group attended the annual dinner of the O.F.N.C. where the Club's work was exhibited. At the Birthday Party in the Museum on April 23, 32 new members received their Club badges from Dr. Alcock and Mr. Frith; special exhibits of the Club's work were displayed, and the Club was treated to a showing of "Nanook of the North", introduced by Dr. Leechman. At the annual meeting on December 6 the Group committees for 1954 were elected and a special film programme was enjoyed by members and friends.

The general progress of the Club was reported upon in the "Newsletter" and the special events in the Ottawa daily papers. One radio broadcast on the Club's work was made in December. The spring issue of "The Little Bear", edited by Mr. Maddox, and the fall issue assembled by Mr. Groh, were marked by an increasingly wide variety of articles,

The Club continued to provide a team of ushers, under the capable leadership of Earl Covert, for the Audubon Screen Tours. Seven of the members were leaders in natural history activities at various summer camps, and two former Senior members have graduated to government field work. The continuing flow of reports from corresponding members indicates that the Club's interests are extending to many other parts of Canada.

Report of the Bird Census Committee

The Christmas Bird Census was taken on December 21, 1952. A total of 39 species and 5,774 individuals was reported. The Christmas Bird Census for all of Canada was published in the January-March, 1953, issue of The Canadian Field-Naturalist.

R. FRITH, President.
H. J. SCOGGAN, Secretary.

STATEMENT OF FINANCIAL STANDING

THE OTTAWA FIELD-NATURALISTS' CLUB, NOVEMBER 30, 1953

CURRENT ACCOUNT

Assets		Liabilities	
Bal. in Bank, Nov. 30/53	\$2,134.66	Audubon Screen Tours, guarantees ..	\$ 750.00
Bills receivable	240.72	Cheques outstanding	115.00
Lodge, estimated value	280.00	Balance	1,790.38
	<hr/>		<hr/>
	\$2,655.38		\$2,655.38
Receipts		Expenditures	
Bal. in Bank, Nov. 27/52	\$2,827.34	Can. Field-Nat. (6 nos.)	\$2,418.00
Fees:		Editor's Honorarium	100.00
Current	\$1,579.76	Business Mgr's Hon.	15.00
Advance and Arrears ...	220.66	Separates	394.70
Assoc.	25.00	Illustrations	287.69
	<hr/>	Postage & Stationery	152.29
	1,825.42	Exc. & Lectures Comm.	100.00
Separates	402.78	Newsletter	66.98
Back numbers	398.90	Macoun Field Club	20.00
Miscellaneous	53.60	Membership campaigns	105.43
Audubon Tours (net)	297.91	Bank disct. & exchange	46.09
	<hr/>	Miscellaneous	80.11
		Bal. in Bank, Nov. 30/53 ..	\$2,134.66
		Less o/s cheques	115.00
			<hr/>
		Corrected Bal.	2,019.66
	<hr/>		<hr/>
	\$5,805.95		\$5,805.95

RESERVE FUND

Assets		Liabilities	
Hydro-Electric Power Com. Ont.,		NIL	
Bonds 3%	\$3,000.00		
Bal. in Bank, Nov. 30/53	382.28		
	<hr/>		
	\$3,382.28	Expenditures	
Receipts		Rent safety deposit box	\$ 5.00
Bal. in Bank, Nov. 27/53	\$ 293.16	Bal. in Bank, Nov. 30/53	382.28
Bank interest	4.12		
Bond interest	90.00		
	<hr/>		
	\$387.28		<hr/>
			\$387.28

PUBLICATION FUND

Assets		Liabilities	
Hydro-Electric Power Comm. Ont.,		NIL	
Bonds, 3%	\$1,500.00		
Bal. in Bank, Nov. 30/53	245.18		
	<hr/>		
	\$1,745.18	Expenditures	
Receipts		Balance in Bank, Nov. 30/53	\$ 245.18
Bal. in Bank, Nov. 27/52	\$ 197.40		
Bank interest	2.78		
Bond interest	45.00		
	<hr/>		
	\$ 245.18		<hr/>
			\$ 245.18

Audited and found correct.

(Signed) I. L. Connors,

C. Frankton,

Auditors.

Nov. 30, 1953.

R. J. Moore,

*Treasurer.***CHRISTMAS BIRD CENSUS — 1953**

St. John's, Nfld. — (Selected areas within the city and on the harbour front). — Dec. 26, 1953; 9.15 a.m. to 1.00 p.m.; temp. 42°F.; overcast in a.m. followed at noon by worst rainstorm of the year; little snow on ground; 6 observers in two parties; total miles, 4 (on foot). — Sharp-shinned Hawk, 2; Pigeon Hawk, 1; Glaucous Gull, 55; Iceland Gull, 26; Great Black-backed Gull, 3; Herring Gull, 63; Unidentified Gulls, 47; Yellow-shafted Flicker, 3; Raven, 1; Black-capped Chickadee, 14; Brown-capped Chickadee, 17; Robin, 54; Golden-crowned Kinglet, 7; Northern Shrike, 1; Common Starling, 174; English Sparrow, 383; Pine Grosbeak, 17; Song Sparrow, 1. Total, 17 species; 869 individuals. — Darroch Macgillivray, Master John Macgillivray, Philip Rendell, David

Rendell, Leslie Tuck, Master Wayne Tuck, "Dick" Winter (Newfoundland Natural History Society).

Halifax N.S. — (Banding Station in Marlborough Woods, and Halifax City Dump, on the shores of Bedford Basin). Dec. 27; 8 a.m. to 4:30 p.m.; Temp. 35° to 40°; wind N.E. gusty 15 to 25 mi. per hr.; skies overcast; ground bare and soft; Total party-hours 8½. Herring Gull, 666; Great Black-backed Gull, 7; Downy Woodpecker, 2; Blue Jay, 3; Crow, 5; Black-capped Chickadee, 4; Robin, 1; Starling, 71; English Sparrow, 23; Song Sparrow, 2. Total, 10 species; 784 individuals. (Seen recently in area Baltimore Oriole, 1; Yellow Warbler, 1.) — Mr. and Mrs. W. J. Mills.

Wolfville, N.S. — Dec. 31, 1953; 8.00 a.m. to 4.30 p.m.; 11 observers in 5 parties; total miles 182 (139 by car, 43 on foot); temperature 30-35°; Wind north 10 m.p.h. by evening; overcast with intermittent snow. Canada Goose, 121; Black Duck, 260; Golden-eye, 9; Merganser, 1; Sharp-shinned Hawk, 1; Red-tailed Hawk, 1; Rough-legged Hawk, 5; Bald Eagle, 1; Bobwhite Quail, 15; Ruffed Grouse, 5; Wilson's Snipe, 1; Great Black-backed Gull, 60; Hungarian Partridge, 9; Pheasant, 96; Herring Gull, 2095; Snowy Owl, 1; Flicker, 2; Hairy Woodpecker, 7; Downy Woodpecker, 1; Horned Lark, 54; Blue Jay, 44; Raven, 30; Crow, 748; Black-capped Chickadee, 117; Brown-capped Chickadee, 18; White-breasted Nuthatch, 5; Brown Creeper, 1; Robin, 3; Golden-crowned Kinglet, 21; Northern Shrike, 2; Starling, 632; English Sparrow, 1063; Evening Grosbeak, 3; Redpoll, 15; Pine Siskin, 5; Goldfinch, 23; Junco, 54; Tree Sparrow, 21; Song Sparrow, 19. Total species 39; total individuals 5569. (Seen recently in area Pileated Woodpecker, Mourning Dove, Canada Jay, Red-breasted Nuthatch, Vesper Sparrow).—J. Clarke, A. Erskine, J. Erskine, R. Erskine, M. Forbes, M. Gibson, M. Miller, W. Schofield, A. Sexton, F. Sexton, R. Tufts.

West Middle Sable, N.S. — (Matthews Lake and Hemeon Head to Sable River and 1 m. N., also Little Port l'Hebert to Sable River; all within 7.5 mi. of school in W. Mid. Sable; mixed woods, largely coniferous, 38%; ocean shore, 25%; sheltered brackish water, 24%; sand beach, 7%; scattered rural community, 6%). — Dec. 28, 1953; 8.10 a.m. to 4.30 p.m. 50% cloudy to 10.00 a.m., completely overcast thereafter; temp. 12° to 33°; wind, none to SW 15 m.p.h.; ground bare, ice from previous night only. Two observers in 2 parties and one at feeding-station. Total party-hours, 13½ (10 on foot, 2½ by bicycle, 1 by car); total party-miles, 59 (30 by car, 16 by bicycle, 13 on foot). Horned Grebe, 2; European Cormorant, 71; Canada Goose, 6512; Black Duck, 867; Greater Scaup, 15; Am. Golden-eye, 89; Buffle-head, 3; Oldsquaw, 4; Common Eider, 59; White-winged Scoter, 4; Surf Scoter, 3; Am. Scoter, 1; Am. Merganser, 25; Red-breasted Merganser, 17; Sharp-shinned Hawk, 1; Ruffed Grouse, 4; Red-backed Sandpiper, 11 (H.F.L. and H.F.T.); Great Black-backed Gull, 6; Herring Gull, 225; Black-legged Kittiwake, 1; Hairy Woodpecker, 2; Downy Woodpecker, 1; Can-

ada Jay, 6; Blue Jay, 2; Common Raven, 5; Am. Crow, 31; Black-capped Chickadee, 10; Acadian Chickadee, 19; Golden-crowned Kinglet, 2; Common Starling, 257; Myrtle Warbler, 6; House Sparrow, 20; Eastern Meadowlark, 5; (H.F.L.); Song Sparrow, 1. Total, 34 species; about 8287 individuals. — Laura N. Lewis, Harrison F. Lewis, Harold F. Tufts.

Quebec, Que. (Quebec city, Plains of Abraham to Sillery, Bois Gomin Road, Ste. Foy and Quebec bridge area, La Canardière road to St. Gregoire, Quebec Zoological Garden and Charlesbourg; town suburbs 29%, fields 9%, coniferous forests 6%, deciduous woods 10%, mixed woodlands 28%, shores 18%. — Dec. 28; 7:30 a.m. to 4 p.m. Heavy snow till 10 a.m., overcast; temp. 14° to 26°; wind NE, 1-3 m.p.h.; 10-17 inches of snow on ground; small rivers partly frozen; numerous moving icefields on St. Lawrence river. Nine observers in 5 parties. Total party-hours, 25 (22 on foot, 3 by car), total party-miles, 69 (29 on foot, 40 by car). — Am. Golden-eye, 4; Ruffed Grouse, 1; Ring-necked Pheasant, 3; Iceland Gull, 2; Great Black-backed Gull, 3; Herring Gull, 60; Downy Woodpecker, 3; Blue Jay, 9; Am. Crow, 10; Black-capped Chickadee, 20; Red-breasted Nuthatch, 3; Am. Robin, 2; Cedar Waxwing, 6; Gray Shrike, 2; Common Starling, 243; House Sparrow, 482; Evening Grosbeak, 16; Purple Finch, 17; Pine Grosbeak, 16; Common Redpoll, 28; Pine Siskin, 8; White-winged Crossbill, 40; Snow Bunting, 3. Total, 23 species; 981 individuals. (Seen in area Dec. 27. Hairy Woodpecker, 1; Dec. 24. Golden-crowned Kinglet, 1). — R. Cayouette (compiler), R. Dumais, P. Fiset, P. Germain, P. Grenier, F. Hamel, R. Lepage, L.-A. Lord, G. Moisan (La Société Zoologique de Québec).

Lennoxville, Que. — (Lennoxville to Johnsville and Lennoxville to Sherbrooke). — Dec. 26; 9.45 a.m.-4.00 p.m.; cloudy; temp. 28°; ground covered with 1 inch of snow; three observers in 2 parties; total party-hours, 5, total party-miles, 34 (30 by car, 4 on foot). Am. Golden-eye, 2; Am. Merganser, 8; Ruffed Grouse, 1; Herring Gull, 9; Downy Woodpecker, 1; Blue Jay, 1; Crow, 3; Black-capped Chickadee, 2; Brown-capped Chickadee, 1; Red-breasted Nuthatch, 2; Am. Robin, 1; Common Starling, 8; English Sparrow, 65; Pine Grosbeak, 2; White-winged Crossbill, 21; Tree Sparrow, 6; Snow Bunting, 54. Total, 17 species, 207 individuals. — F. G. LeBaron, D. G. M. Lawrence, A. N. Langford.

Montreal, Que. — (Mount Royal, Westmount Mt., Dorval, Saraguay, Ahuntsic, Montreal North, Cote St. Luc, St. Helen's Island, Nun's Island, south shore St. Lawrence River from Mercier Bridge to Longueuil, north shore from Mercier Bridge to Victoria Bridge). — Dec. 27, 1953; clear; temperature 7° to 13°F.; wind W. to SW light; 4 inches snow in open country; ice moderate along shores of river; 30 observers in 8 parties; total party-hours 53; total party-miles 138 (42 on foot, 94 by car, 2 in boat). Red-necked Grebe, 1; Horned Grebe, 2; Pied-billed Grebe, 2; Canada Goose, 1; Mallard, 63; Black Duck, 1575; Am. Widgeon, 3; Pintail, 155; Greater Scaup, 2; Am. Golden-eye, 266; Am. Merganser, 90; Rough-legged Hawk, 3; Sparrow Hawk, 3; Ring-necked Pheasant, 15; Am. Coot, 1; Great Black-backed Gull, 30; Herring Gull, 489; Ring-billed Gull, 13; Screech Owl, 1; Snowy Owl, 4; Hairy Woodpecker, 13; Downy Woodpecker, 17; Am. Three-toed Woodpecker, 2; Horned Lark, 2; Raven, 1; Crow, 4; Black-capped Chickadee, 31; White-breasted Nuthatch, 7; Brown Creeper, 9; Winter Wren, 2; Robin, 6; Golden-crowned Kinglet, 4; Cedar Waxwing, 1; Gray Shrike, 1; Starling, 43; House Sparrow, 120; Purple Finch, 3; Goldfinch, 25; Redpoll, 5; Junco, 3; Tree Sparrow, 69; Song Sparrow, 12; Snow Bunting, 402. Total species, 43; total individuals, 3501. — B. C. Borden, Miss S. Boyer, J. Brierly, R. Carswell, Mrs. H. Chalk, J. D. Cleghorn, P. du Boulay, Mrs. P. du Boulay, Miss G. Hibbard, A. W. Kelly, P. Landrey, A. R. Lepingwell, H. Longley, J. Lowther, C. McKinnes, I. McLaren, P. Mitchell, G. H. Montgomery, J. Montgomery, Miss I. Rhein-Knudsen, Mrs. P. Roberts, J. Robinson, D. Ryan, C. Sait, Mrs. E. Sala, M. Seymour, Miss M. Smith, Dr. J. Summerby, Miss W. Wilson, R. Yates (Prov. Que. Soc. for the Protection of Birds).

Hudson Heights, Hudson and Como, P.Q. — (Southward of the south shore of the Lake of Two Mountains, widening of Ottawa river, extending between Como station road on the east and Harwood Road about 4 miles westward. Including parts of the residential areas of the villages of Como, Hudson and Hudson Heights, the Pine Lake Bird Sanctuary in Hudson, 300 acres, the Whitlock Bird Sanctuary in Hudson Heights, 1250 acres, part of which, 200 acres, is the Whitlock golf course, and, in addition, a farm area extending about 1 mile southward from Highway 17, Montreal to Ottawa, and about ½ mile in

width, situated about ¼ mile east of the junction of said highway with the Como station road; and also an area of about 1 square mile situated westward of Cote St. Charles Road, its centre about 1¼ miles southward of Highway 17; sandy uncultivated grasslands with brush areas of birch and poplar and scattered evergreens 11%, farmlands with mixed deciduous and evergreen woodlots 21%, golf course with similar woodlots 15%, village roads and gardens 18%; deciduous woods 9%, evergreen woods 21%, second growth scrub areas, 5%). — Jan. 2; 7:30 a.m. to 4:30 p.m., clear to noon, temp. 2° to 8°, wind light W by S; then snowing, wind W, to 15 m.p.h., temp. to 6°; ground covered with snow, water frozen except in streams in a few sheltered places. Thirty-one observers in 9 parties. Total party-hours, 52 (42 on foot, 10 on skis); total party-miles, 56 (41 on foot, 15 on skis). Ruffed Grouse, 22; Pileated Woodpecker, 2; Hairy Woodpecker, 20; Downy Woodpecker, 9; Blue Jay, 59; Canada Jay, 1; Black-capped Chickadee, 231; White-breasted Nuthatch, 34; Red-breasted Nuthatch, 4; Brown Creeper, 1; Golden-crowned Kinglet, 30; Common Starling, 28; English Sparrow, 58; Bronzed Grackle, 1; Common Redpoll, 68; Am. Goldfinch, 30; Red Crossbill, 7; White-winged Crossbill, 198 (150 est., 48); Am. Tree Sparrow, 9. Total, 19 species; about 812 individuals. (Seen in area during count period. Evening Grosbeak, 6; Snow Bunting, 500 (est.). — Niel Baird, Pat Baird, Audry Bryan, Vi Bryan, Mrs. A. Butler, Amy Clarke, Marnie Clarke, Ed Croll, Bob Cundill, Andrea Cundill, Gerald Golden, Peggy Golden (convenor), Dorothy Guerdon, Geo. Guerdon, Clarke Hope, Allan Irwin, Althea Macaulay, Doug. Macaulay, Jr., Jessie MacDonald, Robin MacDuff, Harry Marpole, John Mullan, Geof. Ommanney (compiler), Kate Ommanney, Drusilla (Mrs. Geo.) Riley, May Riley, Bob R. Sewell, Frank Smith, Vera Smith, Jo. Wright, Mack Yuile.

Ottawa, Ont. (roughly a radius of 7½ miles: Central Experimental Farm, Bronson's Swamp; Rockcliffe, Mine Road to Sink Lake to Aylmer; Woodroffe; Chelsea; Brewery Creek, Gatineau Point, Ironside; Britannia and south of No. 17 Highway to Pinecrest; Champlain Bridge, Aylmer Road; Bowesville Road, Prescott Highway; Rideau Dump to Uplands Airport; City View; Manor Park to Airport). — December 27; 9:00 a.m. to 4:00 p.m. Clear, cool; winds south-west, 10 m.p.h.; tempera-

ture 2° to 10°; depth of snow 2 to 5 inches. Twenty-six observers in 12 parties. Total party-hours, 69¾; total party-miles, 70 on foot and 228 by car. Black Duck, 6; Ring-necked Duck, 7; Buffle-head, 1; American Golden-eye, 404; American Merganser, 65; Sparrow Hawk, 2; Ruffed Grouse, 9; Hungarian Partridge, 33; Ring-necked Pheasant, 15; Herring Gull, 1; Pileated Woodpecker, 2; Hairy Woodpecker, 10; Downy Woodpecker, 19; Blue Jay, 15; Crow, 15; Horned Lark, 1; Black-capped Chickadee, 140; White-breasted Nuthatch, 17; Red-breasted Nuthatch, 1; Brown Creeper, 6; Golden-crowned Kinglet, 14; Northern Shrike, 2; Starling, 311; English Sparrow, 2,180; Red-winged Blackbird, 1; Evening Grosbeak, 18; Goldfinch, 80; Purple Finch, 5; Redpoll, 63; Pine Siskin, 594; Tree Sparrow, 100; Song Sparrow, 1; Snow Bunting, 381. Total 33 species, 5,519 individuals. (Seen in area December 25: Great-horned Owl, 1). — B. A. Fauvel, M. & Mrs. H. Lloyd, R. Frith, Dr. & Mrs. Savile, T. Morland, Dr. & Mrs. C. Frankton, M. Spencer, A. Bourguignon, Miss V. Ross, Mr. & Mrs. A. Riddell, K. Bowles, H. Brown, Dr. & Mrs. J. W. Groves, R. D. Harris, M. Campbell, J. Smith, E. Mills, B. Millman, D. J. Evans, Misses V. Humphreys, S. Hoare (Ottawa Field-Naturalists' Club).

Pakenham, Lanark Co., Ont. — December 26, 1953; 8 a.m. to 4 p.m.; 2 inches of snow; light snow falling, changing to rain at 2 p.m.; no wind; temp. 32° to 36°; 9 miles on foot. Cooper's Hawk, 1; Ruffed Grouse, 1; Hairy Woodpecker, 2; Downy Woodpecker, 1; Blue Jay, 3; Crow, 2; Black-capped Chickadee, 18; White-breasted Nuthatch, 1; Brown Creeper, 2; Starling, 111; House Sparrow, 102; Purple Finch, 11; Common Redpoll, 35; Snow Bunting, 800+. Total 14 species, 1090 individuals. — Edna G. Ross, Verna M. Ross.

Carleton Place, Ont. — (Seven and one half mile radius). — Dec. 26, 1953; 9:30 a.m. to 3:00 p.m., overcast with snow, wind southwest 5 miles per hour, temperature 33, barometer 29.45, depth of snow 1 to 4 inches; total party-hours 30, total party-miles 154 (139 by car, 15 on foot), 6 parties. — Pied-billed Grebe, 1; Black Duck, 1; Ruffed Grouse, 7; Hungarian Partridge, 8; Barred Owl, 1; Pileated Woodpecker, 2; Hairy Woodpecker, 1; Downy Woodpecker, 5; Blue Jay, 16; Am. Crow, 4; Black-capped Chickadee, 133; White-breasted Nuthatch, 8; Golden-crowned Kinglet, 4; Northern Shrike, 1; Starling, 195; English Sparrow, 392; Bronzed

Grackle, 1; Evening Grosbeak, 1; Redpoll, 50; Goldfinch, 10; State-coloured Junco, 1; Tree Sparrow, 18; Snow Bunting, 787. Total species, 23, total individuals 1,647. — G. E. Findlay, Jennifer Findlay, Julie Findlay, H. M. Brown, A. E. Bourguignon, Mrs. H. Marshall, Miss V. Humphreys, J. H. Dack, T. Barnett, W. F. Findlay, E. H. Ritchie, Larry Paul, Mrs. W. F. Findlay, Peter Findlay, D. D. Findlay, Graham Dallimore, Mr. & Mrs. D. K. Findlay, Mrs. Helen Walton.

Brockville, Ont. — (From Brockville to 4 miles west along the St. Lawrence River). — Dec. 29, 1953; 8:30 a.m.-4:30 p.m., cloudy, temperature 30° to 35°, wind west 20-25 m.p.h.; total party-miles 9½ (3 by car, 6½ on foot); very little snow, river open. — Greater Scaup, 56; Am. Golden-eye, 3; White-winged Scoter, 3; Ruffed Grouse, 5; Herring Gull, 104; Black-capped Chickadee, 6; Starling, 40; English Sparrow, 94; Am. Goldfinch, 5. Total species 9; 316 individuals. (Seen in area recently, Bald Eagle, 1). — D. Hurrie.

Kingston, Ont. (7½ mile radius centering on MacDonald Park, Kingston, and including Cataraqui River and Creek, shores and waters of Lake Ontario and St. Lawrence River, Wolfe and adjacent islands; farmland 30%, urban centers 4%, marshes 12%, water, 30%, mixed woodlands 24%). — Dec. 27; 8:00 a.m. to 5:00 p.m. Mostly clear, temp. 8 deg. to 15 deg.; wind NE to E, 10 m.p.h.; average depth of snow 1 inch, small bays, rivers and marshes frozen, larger bodies of water open. Seventeen observers in 4 parties. Total party-hours, 32 (14 on foot, 16 by car, 2 by boat); total party-miles, 230 (74 on foot, 152 by car, 4 by boat). Horned Grebe, 7; Pied-billed Grebe, 1; Mallard Duck, 13; Black Duck, 237; Pintail, 3; Redhead, 11; Greater Scaup, 270; Lesser Scaup, 1; Am. Golden-eye, 709; White-winged Scoter, 1; Am. Merganser, 49; Cooper's Hawk, 1; Am. Rough-legged Hawk, 6; Bald Eagle, 2; Marsh Hawk, 1; Sparrow Hawk, 4; Ruffed Grouse, 10; Am. Coot, 8; Glaucous Gull, 12; Great Black-backed Gull, 147; Herring Gull, 898; Ring-billed Gull, 509; Great Horned Owl, 1; Snowy Owl, 2; Barred Owl, 1; Pileated Woodpecker, 2; Hairy Woodpecker, 11; Downy Woodpecker, 8; Blue Jay, 106; Am. Crow, 1; Black-capped Chickadee, 215; White-breasted Nuthatch, 22; Brown Creeper, 1; Robin, 1; Golden-crowned Kinglet, 3; Northern Shrike, 1; Starling, 849; Myrtle Warbler, 1; House Sparrow, 950; Red-winged Blackbird, 1; Grackle, 1; Evening Grosbeak, 2; Purple Finch, 115;

Am. Goldfinch, 116; White-winged Crossbill, 5; Slate-coloured Junco, 20; Tree Sparrow, 79; Song Sparrow, 6; Snow Bunting, 303. Total, 49 species; 5,723 individuals. (Seen in area Dec. 22. — Bonaparte's Gull, Winter Wren, Pine Siskin). — Mrs. A. G. Argue, Mr. A. E. S. Bell, Mr. F. B. Bishop, Mrs. T. Boardman, Mr. J. Cartwright, Mrs. H. L. Cartwright, Mr. J. Day, Mr. and Mrs. A. E. Hyde, Mr. W. G. Lamb, Mr. S. Peters, Mrs. C. D. Quillian, Miss J. Shortt, Mr. R. B. Stewart (compiler), Dr. G. M. Stirrett, Mr. A. Strong, Dr. C. J. Vincent (Kingston Nature Club).

Rutherglen, Ont. — (From township of Bonfield, villages of Bonfield, Rutherglen, Eau Claire areas around Kaipuskong River, Pimisi Bay, Mattawa River, Smith's Lake, Amable du Fond River, to 10 miles west of Mattawa, open farmland 30%, coniferous woodlots and black spruce bog 5%, second growth mixed forest 50%, lakes and rivers 10%, settlements 5%. — December 30, 1953; 7.30 a.m. to 4.30 p.m.; clear; 0° to -6°F; wind NW, 5-10 m.p.h.; ground covered with 8 to 10 inches of powder snow; all fresh water frozen except rapids and eddies; total hours 9 (8 on foot, 1 by car); total miles 43 (8 on foot, 35 by car): — Am. Golden-eye, 2; Hooded Merganser, 1; Ruffed Grouse, 3; Hairy Woodpecker, 9; Downy Woodpecker, 1; Blue Jay, 20; Northern Raven, 1; Black-capped Chickadee, 53; Red-breasted Nuthatch, 5; Starling, 22; Red Crossbill, 2; Snow Bunting, 27. Total species 12, about 146 individuals. (Seen in area Dec. 28, Evening Grosbeak, 19; Pine Grosbeak, 3; Common Redpoll, 2; Brown Creeper, 1). — Louise de Kiriline Lawrence.

Kirkland Lake, Ont. — (7½ mile radius centering on a point on #112 Highway one mile north of Dane; fields 20%; towns 5%; coniferous woods 30%; deciduous woods 35%; slimes 5%; cattail marsh 5%; 5 feeding stations). — Dec. 26, 1953; 8.00 a.m. to 4.00 p.m.; clear with some clouds; temperature 0° to 10°; wind light, NNE 5 m.p.h.; 7 in. of snow on ground; streams mostly frozen; 22 observers in 9 parties; total party-hours 49 (12 on foot, 12 by car, 25 at feeding stations); total party-miles 171 (30 on foot, 141 by car). — Ruffed Grouse, 1; Hairy Woodpecker, 10; Downy Woodpecker, 1; Canada Jay, 11; Blue Jay, 9; Common Raven, 1; Black-capped Chickadee, 115; Red-breasted Nuthatch, 8; Gray Shrike, 1; Starling, 29; House Sparrow, 100; Pine Grosbeak, 142; Common Redpoll, 23; Snow Bunting, 5. Total

14 species, 456 individuals. (Seen in the area recently: Snowy Owl, 1; Am. Crow, 1). — Mrs. E. Axcell, Mrs. K. W. Bennett, Allan Corbould, C. A. Elsey, K. C. Gray, J. H. Hodgins, Barbara Hodgins, Eileen MacRae, Mr. & Mrs. R. J. McClanahan, Robert McClanahan, Ian M. Robertson, Jim Savage, Mr. & Mrs. J. G. Stephenson, Jack Stephenson, Jim Stephenson, Chas. W. Tully, Mrs. R. Walker, Mr. & Mrs. Frank Washington, Allan Wilson (Kirkland Lake Nature Club).

Peterborough, Ont. — (Radius of 7½ miles including Jackson Park, Lily Lake, Little Lake, Otonabee River, Nassau, Warsaw Road, Heronry, Chemong Park, Burnhams Woods, Rifle Range, Stewart Hall, Otonabee; open farmland 45%; marsh 9%; water 4%; mixed woods 24%; deciduous woods 8%; coniferous woods 10%. — Dec. 26, 1953; 8.45 a.m. to 12.45 p.m.; cloudy with snow, temperature 30-32°; wind 10-15 m.p.h.; lakes and rivers open; 20 observers in 5 parties; total party-hours 16½; total party-miles 70 (52 by car, 18 on foot). — Mallard, 2; Sparrow Hawk, 1; Ruffed Grouse, 10; Killdeer, 1; Herring Gull, 3; Ring-billed Gull, 2; Hairy Woodpecker, 4; Downy Woodpecker, 1; Blue Jay, 6; Crow, 1; Black-capped Chickadee, 141; White-breasted Nuthatch, 1; Brown Creeper, 1; Golden-crowned Kinglet, 4; Northern Shrike, 2; Starling, 275; House Sparrow, 300; Redpoll, 175; Goldfinch, 80; Tree Sparrow, 14; Song Sparrow, 1. Total species 21; total individuals 1,025. — Frank R. Pammett, Larry McKeever (Peterborough Nature Club).

Huntsville, Ont. — December 20, 1953; 9:30 a.m. to 4:30 p.m.; temperature, 36-38 degrees; cloudy; fresh S.W. wind; running water open; 8-10 inches snow; 9 observers in 9 parties. — Ruffed Grouse, 4; Herring Gull, 18; Pileated Woodpecker, 2; Hairy Woodpecker, 7; Downy Woodpecker, 5; Blue Jay, 7; Robin, 1; Black-capped Chickadee, 74; White-breasted Nuthatch, 8; Red-breasted Nuthatch, 4; Brown Creeper, 1; Golden-crowned Kinglet, 6; Northern Shrike, 2; Starling, 52; English Sparrow, 83; Evening Grosbeak, 23; Pine Grosbeak, 7; Siskin, 12; Goldfinch, 325; White-winged Crossbill, 44; Snow Bunting, 155. Total, 21 species; 840 individuals. — B. Jennings, B. McAlpine, A. C. May, K. Perrin, P. Rogers, R. J. Rutter, T. Thomas, Mr. and Mrs. W. Waters (The Huntsville Nature Club).

Toronto, Ont. — Dec. 27, 1953; 7.30 a.m. to 5 p.m.; cloudy bright, wind SE 5 m.p.h.;

ground mostly bare at city except in woods; rivers and ponds mostly ice-covered; temperature 20° to 37°; 99 observers in 24 parties; total hours, 137½. — Holboell's Grebe, 4; Horned Grebe, 1; Great Blue Heron, 5; Mallard, 766; Black Duck, 1,634; Pintail, 8; Greater Scaup, 2,784; Lesser Scaup, 6; Common Golden-eye, 401; Buffle-head, 76; Oldsquaw, 258; Surf Scoter, 3; Ruddy Duck, 1; Am. Merganser, 484; Red-breasted Merganser, 6; Goshawk, 1; Cooper's Hawk, 5; Red-tailed Hawk, 19; Red-shouldered Hawk, 7; Rough-legged Hawk, 3; Marsh Hawk, 2; Duck Hawk, 1; Sparrow Hawk, 47; Ruffed Grouse, 18; Ring-necked Pheasant, 100; Killdeer, 1; Wilson's Snipe, 2; Glaucous Gull, 1; Iceland Gull, 1; Great Black-backed Gull, 9; Herring Gull, 1,638; Ring-billed Gull, 135; Mourning Dove, 9; Screech Owl, 3; Horned Owl, 9; Snowy Owl, 17; Barred Owl, 1; Long-eared Owl, 15; Short-eared Owl, 2; Saw-whet Owl, 3; Belted Kingfisher, 12; Yellow-shafted Flicker, 6; Pileated Woodpecker, 5; Hairy Woodpecker, 68; Downy Woodpecker, 131; Blue Jay, 70; Crow, 79; Black-capped Chickadee, 369; White-breasted Nuthatch, 83; Red-breasted Nuthatch, 19; Brown Creeper, 19; Winter Wren, 9; Carolina Wren, 1; Robin, 24; Golden-crowned Kinglet, 101; Water Pipit, 1; Northern Shrike, 26; Common Starling, 3,145; House Sparrow, 1,429; Eastern Meadowlark, 6; Red-winged Blackbird, 4; Baltimore Oriole, 1 (first on any Toronto Christmas census and the 132nd species identified on 29 consecutive Brodie Club censuses); Rusty Blackbird, 5; Cardinal, 67; Evening Grosbeak, 6; Purple Finch, 287; Common Redpoll, 37; Pine Siskin, 16; Goldfinch, 783; Red Crossbill, 2; Slate-coloured Junco, 573; Oregon Junco, 1; Tree Sparrow, 345; White-throated Sparrow, 1; Fox Sparrow, 1; Swamp Sparrow, 5; Song Sparrow, 73; Snow Bunting, 30. Total, 78 species, 16,326 individuals. — R. Anderson, J. L. Baillie (compiler), H. Bare, H. Barnett, Robt. Bateman, D. Beacham, J. Beacham, G. Bennett, O. D. Boggs, Mrs. G. M. Bramfitt, A. Bunker, D. Burton, L. Butcher, R. Campbell, W. Campbell, G. Clark, C. H. D. Clarke, W. Clarke, R. Corlett, A. Dawe, O. E. Devitt, F. H. Emery, 'Ted' Farley, B. Foster, G. Francis, B. Geale, D. Geale, G. Gibson, C. Goodwin, A. Gordon, Mrs. A. Gordon, W. W. H. Gunn, Paul Harrington, Peter Harrington, D. Hogg, Mrs. H. Hogg, J. Hogg, A. Innis, C. E. Ireson, R. F. James, L. Jaquith, Mrs. L. Jaquith, A. Jeffreys, D. Jensen, F. Keim, R. Knights, G. Lambert, A.

Lamsa, C. Leavens, B. LeVay, Mrs. B. LeVay, F. LeVay, J. LeVay, J. Livingston, D. Marsh, R. McCleary, Mrs. H. McDougall, T. F. McIlwraith, D. S. Miller, W. Milne, A. J. Mit-chener, C. Molony, F. Mueller, T. Murray, 'Pat' Page, R. Pannell, D. E. Perks, M. Porter, A. Reid, H. Richards, D. Ripley, R. C. Ritchie, J. Satterly, R. M. Sanders, D. Scovell, Mrs. D. Scovell, R. Scovell, R. Sennett, F. B. Sharp, J. Sherrin, T. M. Shortt, F. Smith, W. W. Smith, H. H. Southam, J. M. Speirs, D. Sumner, S. Talvila, E. Thorn, R. W. Trowern, R. D. Ussher, Mrs. R. D. Ussher, W. Wasserfall, E. Welch, D. A. West, J. D. West, H. Whyte, W. Williams, M. Wood and J. Woodford (Brodie Club and co-operators).

Kitchener-Waterloo, Ont. — (Kitchener-Waterloo south to Galt concentrating on the areas at Westmount Golf Course, Bridgeport, Natchez Road, Freeport to Homer Watson Memorial Park, Doon, New Dundee, Roseville and Preston-Galt). — Dec. 26, 1953; 8:00 a.m. to 5:00 p.m.; morning overcast with heavy snow-flurries, afternoon brief sunny intervals; temperature 26° to 34°; winds south-west up to 25 m.p.h.; light snow cover; rivers and streams partially open. Twenty observers in 8 parties. Pied-billed Grebe, 1; Great Blue Heron, 1; Canada Goose, 12; Mallard Duck, 41; Black Duck, 101; Redhead, 1; Am. Golden-eye, 59; Am. Merganser, 25; Red-tailed Hawk, 4; Bald Eagle, 1; Marsh Hawk, 1; Sparrow Hawk, 2; Ruffed Grouse, 21; Common Pheasant, 2; Herring Gull, 38; Long-eared Owl, 2; Belted Kingfisher, 4; Hairy Woodpecker, 6; Downy Woodpecker, 14; Blue Jay, 24; Crow, 1; Black-capped Chickadee, 134; Brown-capped Chickadee, 1; White-breasted Nuthatch, 18; Red-breasted Nuthatch, 5; Brown Creeper, 5; Winter Wren, 5; Robin, 2; Hermit Thrush, 1; Golden-crowned Kinglet, 80; Ruby-crowned Kinglet, 1; Cedar Waxwing, 1; Northern Shrike, 1; Starling, 130; House Sparrow, 526; Eastern Meadowlark, 1; Cardinal, 14; Redpoll, 3; Pine Grosbeak, 2; Pine Siskin, 70; Goldfinch, 106; Slate-coloured Junco, 148; Oregon Junco, 1; Tree Sparrow, 70; Swamp Sparrow, 2; Song Sparrow, 3. Total species 45; total individuals 1,691. — Jim Anderson, Fred, Judy and John Bender, Craig Campbell, Eric Carter, Horace Dahmer, Jim Detweiler, Mr. and Mrs. Harry Gould, Mr. and Mrs. E. L. James, Dick Hilborn, Margaret Lemon, Bob Pickering, Morley Preston, Willard Schaefer, Norman Shantz, Russell Tilt, and Roy Dickson (Con- vener).

Hamilton, Ont. (Same as last year). — Dec. 26; 8 a.m. to 5:30 p.m. Cloudy with a few sunny intervals; intermittent light snow; temp. 30° to 35°; wind SW, 25 m.p.h.; ground mostly bare, but 6 inches snow in upland woods; marshes frozen, harbour and lake open. Fifty-four observers in 26 parties. Total party-hours, 134 (117 on foot, 17 by car), total party-miles, 334 (158 on foot, 176 by car). Common Loon, 2; Horned Grebe, 8; Whistling Swan, 3; Mallard, 233; Black Duck, 385; Redhead, 3; Ring-necked Duck, 1; Canvasback, 6; Greater Scaup, 762; Lesser Scaup, 320; Am. Golden-eye, 715; Buffle-head, 68; Old-squaw, 37; King Eider, 1 (D.B., L.G., D.P.); White-winged Scoter, 12; Ruddy Duck, 7; Hooded Merganser, 33; Am. Merganser, 6,300; Red-breasted Merganser, 51; Sharp-shinned Hawk, 1; Cooper's Hawk, 1; Red-tailed Hawk, 19; Rough-legged Hawk, 2; Bald Eagle, 3; Marsh Hawk, 1; Pigeon Hawk, 1 (falcon shape, size, all blue upperparts seen from above by H.K.); Sparrow Hawk, 14; Ruffed Grouse, 15; Ring-necked Pheasant, 26; Glaucous Gull, 2; Iceland Gull, 1; Great Black-backed Gull, 77; Herring Gull, 8,500; Ring-billed Gull, 950; Screech Owl, 2; Horned Owl, 3; Snowy Owl, 4; Long-eared Owl, 4; Short-eared Owl, 1; Saw-whet Owl, 1; Belted Kingfisher, 5; Yellow-shafted Flicker, 2; Hairy Woodpecker, 26; Downy Woodpecker, 66; Eastern Phoebe, 1 (J.D., G.N., D.P.); Horned Lark, 2; Blue Jay, 60; Am. Crow, 38; Black-capped Chickadee, 243; White-breasted Nuthatch, 25; Red-breasted Nuthatch, 4; Brown Creeper, 18; Winter Wren, 2; Carolina Wren, 2; Am. Robin, 6; Eastern Bluebird, 1 (J.D., J.W.); Golden-crowned Kinglet, 25; Cedar Waxwing, 47; Gray Shrike, 5; Common Starling, 3250; House Sparrow, 1770; Rusty Blackbird, 2; Brown-headed Cowbird, 2; Cardinal, 83; Evening Grosbeak, 10; Purple Finch, 66; Am. Goldfinch, 113; Slate-colored Junco, 389; Am. Tree Sparrow, 501; Field Sparrow, 8 (W.H., G.N.); Swamp Sparrow, 8; Song Sparrow, 27. Total, 72 species; about 25,382 individuals. (Seen in area Dec. 20; Great Blue Heron, 1; Dec. 31: Arctic Woodpecker, 1; Jan. 1: Pintail, 2; Surf Scoter, 1; Killdeer, 2; Water Pipit, 2; Lapland Longspur, 20; Snow Bunting, 60; Jan. 2: Bonaparte's Gull, 1; House Wren, 1 (J.D., G.N.); Myrtle Warbler, 1; Pine Siskin, 1; Jan. 3: Red-throated Loon, 1; Pied-billed Grebe, 1; Jan. 9: Gannet, 1.) — Jack Aikman, Jas. L. Baillie, Eric W. Bastin, Paul Boleantu, Stella Brown, Mr. and Mrs. R. D. F. Bourne, Don Bucknell, William I. Campbell, Kenneth

J. Cox, Harold Cunliffe, James A. N. Dowall, Robert O. Elstone, Bob Finlayson, Leopold Fucikovsky, Leslie Gray, Peter Hammel, Ian Halladay, John Hencher, Peter F. Henderson, Mr. and Mrs. W. R. Holley, Charles Hunter, Angus B. Jackson, Herbert E. Kettle, Patricia Kirkwood, Barbara Laking, Leslie Laking, Margaret Lamb, Julius Mannheimer, C. Douglas McCallum, George O. McMillan, Mrs. Lester L. Merrick, John J. Miller, John W. Moule, Albert B. Nind, George W. North (compiler), Mrs. Jessie Orlick, Mr. and Mrs. C. L. Powell, David K. Powell, Morley C. Sabine, Robert K. Sargeant, Lister S. Sinclair, Robert W. Smith, Robert W. Stamp, Laura Stewart, Misses Anne, Jane, and Mabel Watson, Mr. and Mrs. M. R. Watters, Mervyn White, J. Harvey Williams (Hamilton Nature Club).

West Elgin, Ont. (7½-mile radius centering one and one-half miles north of West Lorne; conifer groves 2%, deciduous woods 25%, lake front 6%, river hillsides and creek gulley 40%, agricultural land 10%, pasture 15%, feeding stations 2%. — Dec. 26; 7:30 a.m. to 5 p.m. Cloudy gradually clearing; temp. 30° to 38°; wind W, 18-20 m.p.h.; some drifted snow in protected places; river frozen except rapids, lake clear of ice. Seventeen observers in 9 parties. Total party-hours, 46½ (41 on foot, 5½ by car); total party-miles, 157 (60 on foot, 97 by car). Black Duck, 3; Am. Golden-eye, 55; Am. Merganser, 5; Cooper's Hawk, 2; Red-tailed Hawk, 28; Red-shouldered Hawk, 5; Rough-legged Hawk, 6; Bald Eagle, 5; Marsh Hawk, 14; Sparrow Hawk, 4; unidentified Hawks, 5; Ruffed Grouse, 6; Bob White, 41; Pheasant, 11; Herring Gull, 127; Ring-billed Gull, 5; Bonaparte's Gull, 2; unidentified Gulls, 85; Mourning Dove, 42; Screech Owl, 2; Great Horned Owl, 5; Yellow-shafted Flicker, 2; Pileated Woodpecker, 1; Red-bellied Woodpecker, 2; Hairy Woodpecker, 12; Downy Woodpecker, 48; Horned Lark, 13; Blue Jay, 76; Am. Crow, 26; Black-capped Chickadee, 66; White-breasted Nuthatch, 34; Red-breasted Nuthatch, 2; Brown Creeper, 12; Winter Wren, 2; Robin, 5; Golden-crowned Kinglet, 35; Gray Shrike, 1; Starling, 427; House Sparrow, 1,103; Cardinal, 105; Purple Finch, 20; Pine Siskin, 25; Am. Goldfinch, 221; Eastern Towhee, 12; Slate-coloured Junco, 325; Tree Sparrow, 377; Fox Sparrow, 1; Song Sparrow, 22; Snow Bunting, 30. Total, 47 species; approximately 3,367 individuals. (Seen recently, Saw-whet Owl, Snowy Owl, Short-eared Owl, Eastern Meadowlark). — W. Fawcett, Leroy Fulmer,

Robert Hopper, Donald Johnston, E. R. Lancaster, H. L. Lancaster (compiler), James Lemon, R. E. Lemon, V. E. Lemon, Gary Martelle, Donald Mylrea, Louise Mylrea, David Murray, Donald Murray, Douglas Murray, Dr. A. C. Steele, Graham Vogan (West Elgin Nature Club).

Sarnia, Ont. — (St. Clair River and shore of Lake Huron at Point Edward and Canatara Park; east along Lake Shore Road to the Plympton Town Line, then south to the Town Line of Moore and small area 6 miles east of Sarnia on Lake Huron shore). — Dec. 26, 1953; 8 a.m. to 5 p.m.; overcast in the morning, clear in the afternoon; temperature 31°; wind 15 m.p.h.; 9 observers in 2 parties. — Horned Grebe, 3; Pied-billed Grebe, 1; Mallard Duck, 18; Black Duck, 65; Redhead Duck, 25; Lesser Scaup Duck, 1; Am. Golden-eye, 50; Old-squaw Duck, 3; White-winged Scoter, 1; Hooded Merganser, 2; Am. Merganser, 400; Red-breasted Merganser, 20; Cooper's Hawk, 1; Rough-legged Hawk, 3; Marsh Hawk, 7; Pheasant, 2; Herring Gull, 120; Ring-billed Gull, 1; Mourning Dove, 60; Belted Kingfisher, 2; Hairy Woodpecker, 2; Downy Woodpecker, 5; Arctic Three-toed Woodpecker, 1; Horned Lark, 175; Blue Jay, 26; Am. Crow, 33; Black-capped Chickadee, 1; Tufted Titmouse, 2; White-breasted Nuthatch, 6; Am. Robin, 1; Golden-crowned Kinglet, 5; Northern Shrike, 2; Starling, 350; English Sparrow, 500; Red-winged Blackbird, 1; Cowbird, 5; Cardinal, 5; Am. Goldfinch, 7; Slate-coloured Junco, 22; Tree Sparrow, 37; Lapland Longspur, 20. Total 41 species, 2,398 individuals. — Trevor Storey, M. Carscallen, C. Carscallen, J. Carscallen, Dr. Arthur Storey, Dave Johnson, Don McKenzie, John Hext, Angus Buchanan.

Port Arthur - Fort William, Ont. — Dec. 26, 1953; temperature 8° to 11°; wind NNW 4-8 m.p.h.; relative humidity was 80%; snow up to 11 inches; some open water near shore of Lake Superior; 27 observers in 15 parties; total party-hours 26; total party-miles 155 (122 by car, 33 on foot). — Black Duck, 2; Golden-eye, 47; Rough-legged Hawk, 2; Herring Gull, 215; Snowy Owl, 1; Great Grey Owl, 1; Hairy Woodpecker, 7; Downy Woodpecker, 9; Canada Jay, 4; Blue Jay, 19; Raven, 36; Crow, 6; Black-capped Chickadee, 91; Red-breasted Nuthatch, 2; Robin, 1; Northern Shrike, 2; Starling, 219; House Sparrow, 2,137; Evening Grosbeak, 7; Pine Grosbeak, 65; Common Redpoll, 20. Total 31 species, 2,893 individuals. Seen recently

in area, Mallard, 2). — Mr. & Mrs. P. Addison and sons Bill, Peter and Edward, Dr. A. E. Allin, M. J. Armstrong, Mr. & Mrs. R. B. Beckett, Mr. & Mrs. R. M. Beckett, David Bianco, H. Ken Campbell and son Howard, Keith Denis and son Norman, Mr. & Mrs. Ken Eoll, Claude E. Garton, Mr. & Mrs. A. Hanton, Mrs. M. Knowles, Mrs. C. R. Rogers, Mr. & Mrs. C. Rydholm and daughter Louise, J. Thompson and Dr. E. N. Wright. (Thunder Bay Field-Naturalists' Club).

Yorkton, Sask. — (7½-mile radius centering on Yorkton; same area as previous years). — Dec. 26, 1953; 8 a.m. to 5 p.m. Overcast; temp. 14° to 29°; wind SW to W, 10-15 m.p.h.; ground covered with 2-in snow. Twenty-three observers in 6 parties. Total party-hours, 24 (10½ on foot, 13½ by car); total party-miles, 143 (12 on foot, 131 by car). Am. Bittern, 1; Ruffed Grouse, 3; Sharp-tailed Grouse, 36; Hungarian Partridge, 8; Horned Owl, 1; Snowy Owl, 2; Short-eared Owl, 6; Hairy Woodpecker, 4; Downy Woodpecker, 4; Blue Jay, 3; Am. Magpie, 23; Black-capped Chickadee, 58; White-breasted Nuthatch, 1; Common Starling, 25; House Sparrow, 443; Evening Grosbeak, 7; Pine Grosbeak, 14; Common Redpoll, 125 (est.); Slate-coloured Junco, 50 (est.); Snow Bunting, 396 (est.). Total, 20 species, 1,210 individuals. (Female Baltimore Oriole trapped and banded Dec. 17; Robin banded Dec. 17; Bohemian Waxwings not seen since Dec. 20; Seen in same area Dec. 22 — two Golden-crowned Kinglets; Dec. 30, Am. Robin). — Tyrone Balacko, Mr. and Mrs. Brian Bjarnason, Wayne Bjorgan, Brother Clarence, Lionel Coleman, Ronald Coleman, Dr. and Mrs. Stuart Houston (compilers), Brother Justin, Preston MacDonald, Mrs. W. J. McDonald, Allan Nurse, Jack Park, Phil Pawluck, Greg Pearce, Irving Pearce, Wayne Pearce, Cliff Shaw, Frank Switzer, Gillean Switzer, Brother Vincent, D'Arcy Wershler. (Yorkton Natural History Society).

Grande Prairie, Alberta. (300 miles northwest of Edmonton) (7½ mile radius centered at a point in the town of Grande Prairie; activity concentrated in the south-western sector; coniferous woods 10%, deciduous woods 27%, cultivated fields 45%, town 5%, alder swamp 10%, lake shore, 3%.) — Dec. 26, 8.15 a.m. to 6.15 p.m. Overcast, clearing at 9.30 a.m.; temperature 27.3° to 36.2°; wind W, 20-14 m.p.h.; ground covered with 3" to 4" of snow; no open water. Three observers together. Total party-hours, 10 (5

on foot, 5 by car); total party-miles, 116 (10 on foot, 106 by car). Golden Eagle, 1 (adult seen directly overhead in excellent light and followed for several miles by car); unidentified Hawk 2; Ruffed Grouse, 1; Horned Owl, 1; Snowy Owl, 4; Short-eared Owl, 9; Hairy Woodpecker, 1; Downy Woodpecker, 1; Canada Jay, 11; Am. Magpie, 16; Black-capped Chickadee, 21; Brown-capped Chickadee, 1; Gray Shrike, 1; House Sparrow, 92 (60 ± 10 , 32); Pine Grosbeak, 1; Common Redpoll, 103 (65 ± 15 , 38). Total, 15 species; about 266 individuals. (Seen recently in area: Gyrfalcon, Sharp-tailed Grouse, Bohemian Waxwing, Evening Grosbeak, Snow Bunting.) — Fred Helleiner, R. Fraser Smith, Donald Thomson.

Vernon, B.C. — (West to Okanagan Landing, north to Buckerfields Ranch, south to Kalamalka Lake and east to Coldstream Ranch). — Dec. 20, 1953; 9.00 a.m. to 3.30 p.m.; low overcast with light steady rain beginning about noon; wind light; temperature 32° to 42° ; one to five inches of snow; Okanagan and Kalamalka Lakes clear of ice; Swan Lake mostly frozen; 12 observers in 3 parties. — Horned Grebe, 11; Western Grebe, 4; Great Blue Heron, 4; Mallard, 652; Pintail, 2; Green-winged Teal, 2; Baldpate, 700; Redhead, 77; Lesser Scaup, 30; Am. Golden-eye, 451; Buffle-head, 8; Barrow's Golden-eye, 2; Am. Merganser, 4; Hooded Merganser, 7; Am. Rough-legged Hawk, 1; Sparrow Hawk, 2; European Partridge, 2; Pheasant, 191; Coot, 1,042; Killdeer, 4; Wilson's Snipe, 1; Herring Gull, 4; Mourning Dove, 24; Pygmy Owl, 2; Short-eared Owl, 1; Belted Kingfisher, 2; Red-shafted Flicker, 52; Hairy Woodpecker, 4; Downy Woodpecker, 2; Horned Lark, 5; Steller's Jay, 4; Crow, 50; Clarke's Nutcracker, 2; Magpie, 25; Black-capped Chickadee, 56; Mountain Chickadee, 3; Red-breasted Nuthatch, 8; White-breasted Nuthatch, 4; Pygmy Nuthatch, 13; Creeper, 2; Dipper, 2; Long-billed Marsh Wren, 1; Solitaire, 1; Golden-crowned Kinglet, 3; Bohemian Waxwing, 1,127; Northern Shrike, 7; Meadowlark, 32; English Sparrow, 437; Brewer's Blackbird, 165; Red-winged Blackbird, 60; Evening Grosbeak, 179; Pine Grosbeak, 26; Am. Goldfinch, 116; Oregon Junco, 527; Tree Sparrow, 2; White-crowned Sparrow, 64; Song Sparrow, 48. Total, 57 species, 6,257 (approx.) individuals. (Seen recently in area, Marsh Hawk, 2). — H. Baerg, Miss K. Bartholomew, J. B. Beddome, D. Campbell, J. T. Fowle, J. Grant, A. N. Humphries, C.

McClounie, J. Obana, J. Quirk, D. Ross, B. A. Sugden. (North Okanagan Naturalists Club).

Crescent Beach, B.C. (Parts of coast and bush between Crescent Beach, Ocean Park, and White Rock, including Nicomekl River at Elgin, White Rock Pier, and Semiahmoo Indian Reserve.) December 28th, 1953, 8.30 a.m. to 4.30 p.m., temp. 40° at sunrise; strong westerly wind all day; some sunshine; sea rough; four observers in two parties; total miles 45 (30 by car, 15 on foot). — Common Loon, 3; Red-throated Loon, 2; Horned Grebe, 15; Western Grebe, 26; Cormorant (sp ?) 3; Great Blue Heron, 7; Pintail, 33; Green-winged Teal, 4; Greater Scaup Duck, 800 (plus); Am. Golden-eye, 31; Buffle-head, 30; Oldsquaw, 4; Harlequin Duck, 10; White-winged Scoter, 43; Surf Scoter, 225; Am. Scoter, 67; Am. Merganser, 10; Red-breasted Merganser, 6; Red-tailed Hawk, 1; Ring-necked Pheasant, 2; Am. Coot, 2; Red-backed Sandpiper, 75; Glaucous-winged Gull, 142; Herring Gull, 1; Short-billed Gull, 100 (plus); Belted Kingfisher, 1; Red-shafted Flicker, 13; Downy Woodpecker, 1; North-western Crow, 312; Black-capped Chickadee, 4; Winter Wren, 3; Golden-crowned Kinglet, 19; English Sparrow, 62; Pine Siskin, 50; Spotted Towhee, 3; Savannah Sparrow ? 1; Slate-coloured Junco, 1; Oregon Junco, 143 (plus); Fox Sparrow, 1; Song Sparrow, 12. Total, 40 species, 2,268 individuals. (Least Bush-tits seen in the Ocean Park area on Dec. 29.) H. N. Clarke, M. W. Holdom, H. Newnhouse, E. E. Woodford.

Comox, B.C. — (From one mile south of Courtney, through Courtney along shore line to Comox and head of Bay). December, 27; 9 a.m. to 3:30 p.m.; temp. 40° ; calm, cloudy. Four observers in two parties; total party-hours 12, total party-miles 9. — Common Loon, 5; Red-throated Loon, 2; Pacific Loon, 10; Holboell's Grebe, 7; Western Grebe, 1; Double-crested Cormorant, 5; Pelagic Cormorant, 12; Baird's Cormorant, 3; Great Blue Heron, 5; Mallard, 325; Baldpate, 450; Scaups, 250; Am. Golden-eye, 150; Barrows Golden-eye, 10; Buffle-head, 18; White-winged Scoter, 300; Surf Scoter, 150; Am. Scoter, 1; Ruddy Duck, 2; Hooded Merganser, 2; Am. Merganser, 2; Red-breasted Merganser, 5; Bald Eagle, 1; California Quail, 43; Ring-necked Pheasant, 2; Coot, 4; Killdeer, 1; Glaucous-winged Gull, 500; Thayer's Gull, 3; Short-billed Gull, 18; California Murre, 1; Saw-whet Owl, 1; Kingfisher, 3;

Red-shafted Flicker, 7; Hairy Woodpecker, 3; Raven, 2; North-western Crow, 350; Chestnut-backed Chickadee, 25; Creeper, 2; Bewick's Wren, 3; Winter Wren, 25; Am. Robin, 5; Varied Thrush, 5; Golden-crowned Kinglet, 59; Ruby-crowned Kinglet, 1; Starling, 7; English Sparrow, 40; Western Meadowlark, 1; Red-winged Blackbird, 1;

Brewer's Blackbird, 250; Purple Finch, 23; Evening Grosbeak, 23; Siskin, 1,500; Oregon Towhee, 16; Oregon Junco, 500; Golden-crowned Sparrow, 6; Fox Sparrow, 3; Song Sparrow, 23. — 60 species, 5,559 individuals. (Seen in area recently, Pigeon Hawk, Black Turnstone and Red-backed Sandpipers.) — R. Fryer, D. Guthrie, J. Hames, Theed Pearse.

A NEW WEED, *ERYSIMUM HIERACIIFOLIUM* L. IN CANADA ^{1 2}

C. FRANKTON

A WORMSEED MUSTARD not previously reported for North America is now known to be present in Ontario and Quebec. Recent study of the collections at the Department of Agriculture herbarium at Ottawa, utilizing German and Russian floras, has established the identity of this species as *Erysimum hieraciifolium* L.

Erysimum hieraciifolium, as a native plant, is widely distributed in Europe and Asia. As with many other plants of extensive distribution, there are variations within the species. The Canadian material differs from the Western European and Scandinavian in having much smaller seeds, thicker leaves, and shorter and more appressed siliques. Dr. R. C. Rollins of the Gray Herbarium, who verified the identification of the Canadian specimens, suggests the possibility that they belong to a central European subspecies *strictum*.

The first collection of this plant in Canada was made at Ottawa in 1941 not far from the

Parliament Buildings and this was followed by others near Moose Creek and Apple Hill in the extreme east of the province of Ontario. More recently the range has been extended considerably by collections in Renfrew County and Nipissing District in Ontario, and by a specimen from Laviolette County in Quebec. The infestation about Moose Creek was surveyed in 1950 and the plant was found to be common in an area of about 500 square miles in the counties of Russell, Prescott, Stormont, and Glengarry. Although largely confined to roadsides, field margins and gravel pits, this mustard is occasionally found in pastures, where it is sometimes grazed.

E. hieraciifolium, as it occurs in Canada, is fairly easily recognized by its appressed siliques, very short pedicels and its height, frequently to six feet. The common and widespread wormseed mustard, *E. cheiranthoides* L., known from every Province, is quite distinct from this new weed as is shown in Table 1.

Table 1. Comparison of *E. hieraciifolium* and *E. cheiranthoides*

<i>E. hieraciifolium</i>	<i>E. cheiranthoides</i>
Plants 3 to 6 feet.	Plants to 3 feet, rarely taller.
Biennial or perennial.	Annual or winter annual.
Hairs on the upper surface of leaves predominantly four-parted.	Hairs on the upper surface of leaves predominantly three-parted.
Petals 6 to 8 mm long.	Petals to 5 mm long.
Flowers sulphur yellow.	Flowers pale yellow.
Siliques appressed.	Siliques divergent.
Pedicels of mature siliques about 5 mm in length.	Pedicels of mature siliques 8 mm or more in length.
Seeds 1-1.3 mm long.	Seeds about 1 mm long.

1) Received for publication May 21, 1953.

2) Contribution No. 1284 from the Division of Botany and Plant Pathology, Science Service, Department of Agriculture, Ottawa, Canada.

Small-flowered prairie rocket, *E. inconspicuum* (S. Wats.) MacM., native to North America, should not be confused with either

of these plants. Its grayish appearance, thicker pedicels and the two-parted hairs on the leaves are sufficient for differentiation.

Seeds of *E. hieraciifolium* planted on May 14, 1948, at Ottawa, germinated four days later but flowering did not occur until June 16, 1950. In sharp contrast was the performance of *E. cheiranthoides* planted on the same date and germinating after the same interval: flowering plants were produced on June 29, 1948. The original plant of *E. hieraciifolium* sent up stems which flowered in 1951 and 1952 and was still vigorous at the end of the 1952 growing season. Specimens preserved in the Department of Agriculture herbarium at Ottawa are as follows:

QUEBEC: 40 miles N of Shawinigan Falls, along Highway 19, Laviolette Co., small patch in moist hay field on sandy soil, 1951, *Bassett & Hamel* 1991.

ONTARIO: Near Apple Hill, Glengarry Co., roadside, 1947, *Anderson* 803; 2 miles ENE of Maxville, Glengarry Co., 1950, *Bragg & Mulligan* 247; 1 mile SSE of Lemieux, Prescott Co., common along roadsides and in one

pasture, 1950, *Mulligan & Bragg* 737; Moose Creek, Stormont Co., 1946, *Anderson* 796; Monckland, Stormont Co., 1949, *MacRae*; ¼ mile NW of McMillan Corners, Stormont County, roadside, 1950, *Mulligan & Bragg* 745; 2 miles north of Monckland Station, Stormont Co., covering at least 30 acres around gravel pit and in a poorly grazed pasture, 1950, *Mulligan & Bragg* 742; 3 miles east of Casselman, Stormont Co., common along roadside and in a pasture, 1950, *Bragg & Mulligan* 244; ½ mile SSE of Sandringham, Stormont Co., very common, 1950, *Bragg & Mulligan* 245; ¼ mile SW of Mayerville, Russell Co., scattered plants along roadside, 1950, *Bragg & Mulligan* 242; Ottawa, Carleton Co., behind Confederation Building, 1941, *Wright*; Ottawa South, Carleton Co., abandoned dump, 1950, *Mulligan* 726; Barry Bay, Renfrew Co., waste lot, 1950, *Bassett & Bragg* 1508; 2 miles west of Braeside, Renfrew Co., edge of gravel pit, 1950, *Bassett, Lindsay & Frankton* 1882; 26 miles N of North Bay along Highway 11, Nipissing District, in slight depression along edge of road for 1 mile, on sandy soil, 1951, *Mulligan & Bassett* 791.

TRAPPING OF TRUMPETER SWANS IN BRITISH COLUMBIA¹

R. H. MACKAY

Canadian Wildlife Service, Vancouver, B.C.

THE VISIT of the present Queen Elizabeth II to Canada in 1951 was commemorated by the presentation at Charlottetown, P.E.I., of five trumpeter swans, *Olor buccinator*, as the gift of the Federal Department of Resources and Development and the British Columbia Government. The swans were to be shipped, after capture, to the Severn Wildfowl Trust, Gloucestershire, England.

The task of trapping these large white birds, which winter in British Columbia, rested with the Canadian Wildlife Service. No previous attempt had ever been made to capture trumpeter swans in Canada and it was the problem of the author and D. A. Munro, of that Service, to select a trapping site, devise a trap, catch the swans and supervise their shipment to England.

Wintering Areas

During the winter months the trumpeter swans remain as far north in British Columbia as they can find suitable feeding grounds, which in the interior of the province are limited to small unfrozen areas on swift-flowing streams or at points of turbulence where streams flow into lakes. The number of birds supported by each of these areas is limited by the amount of food available, and for that reason the wintering trumpeter swan population is made up of small, widely-scattered flocks — family groups of five or six swans in most instances. Other flocks of trumpeter swans make their way to the coastal region of British Columbia at the onset of winter, and scattered groups are recorded each year at Vancouver Island, the Queen Charlotte Islands, and at other points along the coast. The largest flock, which varies from 75 to 120

1) Received for publication June 25, 1953.

birds from year to year, winters at Lonesome Lake and along the Atnarko River, some 70 miles up the Bella Coola Valley from Bella Coola, B.C. Another flock of 14 to 20 birds winters quite regularly at Lakelse Lake near Terrace, B.C.

Selection of Trapping Site

Many of the natural feeding areas in British Columbia freeze up during periods of extreme cold. When these cold periods are prolonged the trumpeter swans gradually become weaker and many die of starvation. In order to alleviate this situation, the Canadian Wildlife Service distributes grain supplies to several of its wardens and other co-operators for feeding purposes during critical periods. As the most extensive feeding operations are carried out at Lonesome Lake and as a large number of the swans become quite tame during these operations, it was felt that this area offered the best possibilities for capturing the rare birds.

The author made a visit to Lonesome Lake from July 11 to 14, 1951, in order to investigate the opportunities available for capturing the swans. Mr. R. A. Edwards, Migratory Bird Warden for the Canadian Wildlife Service, his wife, and their daughter Trudy, who reside near the head of Lonesome Lake, were interviewed at that time. It is pertinent to point out here that "The Birches", the Edwards' farmstead, is remote from civilization and almost inaccessible except by airplane. Some 21 miles of arduous mountain footpath lie between it and Atnarko, B.C., on the telegraph line. This path is impassable for extended periods during the winter months, when there is virtually no contact with the outside world except by air. Hagensborg, B.C., about 70 miles down the Bella Coola Valley, is the nearest sizeable community.

When it is necessary to feed the swans, it is done for the most part by Miss Edwards. She has found that the least wasteful method of feeding is to throw the grain into an open stretch of water where it is quickly gobbled up by the hungry swans. When the temperature drops to -40°F. or lower, and even the swiftest parts of the river freeze over, it is an everyday occurrence for Trudy to take axe and saw to cut holes in the ice for feeding places while the swans eagerly wait on the ice nearby. The swans have thus come to recognize their benefactor, and the bolder ones eat out of her hand.

The Edwards family thought at first that the trapping operations might frighten the whole flock from their region, and did not take too kindly to the proposal for capturing six of their white winter friends. However, their fears were allayed by the writer — not without a little misgiving on both sides — and trapping plans were discussed. It was assumed that, as usual, feeding operations would be carried out at certain periods of the winter on the Atnarko River about 250 yards from the Edwards' home. A small creek which enters the Atnarko at this point offers an ideal feeding site for short periods each year, depending on weather conditions. This site appeared well suited for the erection of a trap and offered the best possibilities for capturing the birds.

Trap Construction

Materials for constructing the trap were transported by airplane to Lonesome Lake on November 9, 1951. The author and D. A. Munro went in at the same time to assist with the construction. Mr. R. A. Edwards and Trudy also took part in setting up the trap.

Locally-hewn rough cedar posts and poles were used in order to make the trap as inconspicuous as possible. The posts were embedded about six feet apart, on each bank of the creek near its mouth, and extended approximately 45 feet upstream. Poles about 19 feet long were then nailed on the tops of the posts to form the trap framework. The height of the poles above the level of the stream was close to 9 feet. Thirty-eight fathoms of 30-thread tarred-cotton fishing netting, $3\frac{1}{2}$ -inch mesh by 100 meshes deep, were used to enclose the framework. This netting was stretched over the poles and stapled securely. A sliding door, 12 feet wide and 9 feet high, which could be dropped by means of a trip wire, was erected at the mouth of the trap. A small catching pen 10 feet long, 7 feet wide and 6 feet high was erected on the bank of the creek behind a willow clump and was connected to the main trap by means of a net funnel.

Capturing the Swans

The establishment of regular communication with Lonesome Lake was a very important aspect of the capture. The British Columbia Forest Service kindly lent an S.P.F. radio set which was set up at Lonesome Lake at the time of the November visit. It was therefore possible to make contact with Mr. Edwards

directly from the Forest Service radio station in Vancouver. A weekly schedule was arranged, and conditions at Lonesome Lake were reported regularly throughout the winter.

On January 31, 1952, information was received from Mr. Edwards that several swans had been feeding in the trap and that weather conditions were suitable for the trapping attempt. As a ski-equipped aircraft was not available at Vancouver, it was necessary for D. A. Munro and the author to proceed to Prince George, B.C., where a ski-equipped Junkers airplane was available. Attempts to fly into Lonesome Lake were made on February 3 and 4, but snowstorms in the vicinity of the Itcha Mountains forced returns to Burns Lake and Prince George respectively. Weather conditions grounded all aircraft on February 5, but they cleared on the sixth and a landing was made on Lonesome Lake at 12:30 p.m.

Mortar-net equipment, lent by the United States Fish and Wildlife Service, was test-fired in the afternoon. It was decided to use this equipment only as a last resort, if the box trap should fail.

Miss Edwards, who had been feeding a flock of up to 98 swans, 18 of which were cygnets, was asked to try to feed the swans into the trap on the morning of February 7. She was successful in enticing 7 cygnets and 1 adult into the trap, but the adult and 2 cygnets escaped when the gate was dropped. The remainder of the flock were frightened by the attempts of the five trapped birds to escape and left the feeding area. They sat down on the lake about a mile away.

The cygnets in the trap were then caught, sexed, and banded with coloured plastic bands. It was found that three males weighing 18, 19½ and 20 pounds and two females weighing 14½ and 15 pounds had been captured. These birds were then transferred to a small holding pen near the Edwards' home and the large trap was rebaited and set.

In view of the delay encountered in getting into Lonesome Lake, it was considered expedient to have the aircraft return as soon as weather conditions would permit. It did

not seem advisable to keep the captured birds in the small pen for an extended period and, in any event, attempts to trap an additional cygnet might be made while awaiting the arrival of the airplane. The swans, however, did not return to the feeding area at the mouth of the trap on February 8 and the aircraft arrived in a gusty snowstorm in the late afternoon.

Transportation of the Swans

Travelling crates for the swans were constructed immediately upon their capture. Five crates, 42 inches long, 18 inches wide, and 28 inches high were designed and built by Mr. Edwards with the unskilled help of D. A. Munro and the author. The lumber used was local cedar, cut and dressed by Mr. Edwards in his home-constructed sawmill. Remnants of the fish net used in the construction of the trap were utilized to enclose the crates, while half-inch-mesh galvanized wire served as cage flooring 2 inches above a bottom drop board. The top and three sides of the crates were then covered loosely with gunny sacks.

On loading the Junkers it was found that only four of the crates could be accommodated. Two of the male swans had therefore to be placed in one crate, but they reached their destination with no apparent ill effects.

The trumpeters were carried from Lonesome Lake to England by air transport. Leaving Lonesome Lake at 10:30 a.m. on February 9 the swans arrived in Vancouver, via Prince George, at 6:00 p.m. on the same day, and were given food and water there. R. D. Harris and W. D. Taylor of the Canadian Wildlife Service, Ottawa, cared for the swans during their stay in Montreal from 2:10 p.m. on February 10 until 12:00 p.m. on February 11. The birds were in good condition and ate well. The last leg of the journey across the Atlantic was accomplished without incident, and the swans arrived in England on February 12.

Reports received recently from the Severn Wildfowl Trust indicate that the swans have become quite tame in captivity, and that one will even feed from the hand.

THE PLUMELESS THISTLES (*CARDUUS* SPP.) IN CANADA^{1 2}G. A. MULLIGAN and C. FRANKTON³

THE GENUS *Carduus* in the Compositæ family is estimated to consist of 120 species. None of these species is native to the North American continent and the genus is represented in Canada by three plants of European origin: *C. nutans* L., *C. acanthoides* L., and *C. crispus* L. Two of the species are serious pasture weeds that undoubtedly have not yet reached potential limits in spread and for this reason the genus has considerable agronomic interest.

Species of the genus *Carduus* are frequently misidentified in Canada and information on Canadian distribution is lacking. In this paper an attempt will be made to clarify the taxonomy of the species found in Canada and at the same time introduce some observations on ecology and distribution.

Taxonomy

The genus *Carduus* may be briefly described as follows: herbaceous plants, biennial in habit (Canadian species); stems winged; leaves with spiny margins; heads clustered or solitary at the ends of stems and branches; phyllaries (bractlets of the head) in many rows, imbricated, usually spine-tipped; florets tubular and perfect, usually purple; achenes oblong, with shallow longitudinal grooves, glabrous; pappus of many rows of simple (not plumose) hairs.

The very similar genus *Cirsium*, true thistles, represented in Canada by a number of native and introduced species, has a plumose pappus and can be readily differentiated from *Carduus* by this character.

The only recent study of the genus *Carduus* is that of Arenes (1949). The specimens referred to in his investigation are not available here, but Arenes' descriptions and concepts have been utilized in reaching the following conclusions concerning the Canadian material.

According to the description in Arenes (1949) and the plates in Reichenbach (1853) the form of *C. acanthoides* L. occurring in Canada may be identified as var. *vulgaris* Rechb. This name becomes *C. acanthoides* L.

var. *acanthoides* according to present rules of nomenclature. This typically purple-flowered variety also occurs in two colour forms in Ontario. These are forma *albiflora* (L.) Gross, white-flowered, and forma *ochranthus* Wallr., a creamy yellow form (Hegi 1918).

Two distinct varieties of *C. nutans* L. are found in Canada. One of these occurs chiefly in eastern Canada and the other, for the most part, in western Canada. The eastern variety is *C. nutans* L. subsp. *nutans* var. *typicus* Fiori following the treatment by Arenes. He considers the plant illustrated and described in Britton and Brown (1898) to be this variety. This name becomes *C. nutans* L. var. *nutans* in accordance with the current rules of nomenclature. The western variety is *C. nutans* L. var. *leiophyllus* (Petrovic) Arenes. The Canadian material matches European specimens distributed as *C. leiophyllus* Petrovic (*C. nutans* var. *leiophyllus* (Petrovic) Arenes).

Very few Canadian specimens of *C. crispus* L. are available for study and consequently no attempt has been made to assign sub-specific rank to this material.

Specimens of *Carduus* from several herbaria have been made available to the authors and this facility is gratefully acknowledged. Citations given later in this paper show the initials of these herbaria as follows: University of Toronto (TRT); National Museum of Canada (CAN); Herbar Marie-Victorin (MT); Montreal Botanic Gardens (MBG); Gray Herbarium, Harvard University (GH). Where initials are omitted the citations represent specimens in the herbarium of the Department of Agriculture, Ottawa (DAO).

The accompanying key will assist in the identification of North American material of *Carduus*.

Carduus acanthoides L. var. *acanthoides* — the plumeless thistle

The plumeless thistle occurs in Nova Scotia, Quebec, southern Ontario and British Columbia (see Figure and the citations at the end of this section).

Occurrence of this species in Nova Scotia is mentioned by Fernald (1921) and Roland (1947). Fernald reported this plant as a weed

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2) Received for publication July 21, 1953.

3) Assistant Botanist and Botanist (Weed Investigations), respectively.

KEY TO *CARDUUS* IN CANADA

- A. Heads erect, tending to be clustered, 1.7 to 2.5 cm in diameter; stems with spiny wings just below the heads; phyllaries erect and *not* contracted near base, narrow-lanceolate, tapering into a weak spine; median phyllaries from .7 to 1.2 cm long and .9 to 1.8 mm wide at base; flowers usually purple.
 - B. Stems spiny-winged to head; leaves slightly hairy below, chiefly along the midvein.
 - C. Flowers purple *C. acanthoides* var. *acanthoides*
 - C. Flowers white *C. acanthoides* var. *acanthoides* f. *albiflorus*
 - C. Flowers creamy-yellow *C. acanthoides* var. *acanthoides* f. *ochranthus*
 - B. Stems spiny-winged to just below head; leaves white cottony below, often densely so; flowers purple. *C. crispus*
- A. Heads nodding, usually solitary, mostly over 2.5 cm in diameter; stems usually without spiny wings for some distance below the heads; phyllaries contracting abruptly into a narrow, oblong base and tapering at the tip into a strong spine; middle and outer phyllaries strongly reflexed at the contraction, from 1.8 to 2.6 cm long and 3 to 9 mm in width just above the contraction; flowers always purple.
 - D. Leaves pubescent; heads from 1.1 to 3.9 cm in diameter; involucre bracts or phyllaries with white web-like hairs. *C. nutans* var. *nutans*
 - D. Leaves glabrous; heads from 4.4 to 5.3 cm in diameter; involucre bracts *without* white web-like hairs (glabrous except for minute hairs on the upper surface of the phyllaries). *C. nutans* var. *leiophyllus*

of docks, railroad yards and waste heaps at Yarmouth. Roland stated that the plant is sparingly introduced in waste ground and on ballast at Yarmouth, Sydney, Pictou and Pugwash. Examination of all available specimens indicates that the plumeless thistle occurs only around Yarmouth in Nova Scotia. Specimens collected at Sydney, Pictou and Pugwash, distributed as *C. acanthoides* L., are the welshed thistle (*C. crispus* L.).

Neither Flore Laurentienne by Marie-Victorin (1935) nor the Supplement by Rouleau (1947) make any reference to the presence of *C. acanthoides* in Quebec. The floras of southern British Columbia by Henry (1915) and Eastham (1947) do not list this species. Collections in 1952 have established the presence of the plant in both Provinces.

C. acanthoides reaches its greatest abundance in Ontario. The largest stands are found in the rough pastures of Grey County, north of Owen Sound to Kemble and for a distance of five miles west of Kemble, and in the vicinity of Durham and Flesherton. In adjacent Bruce County it is common north-west of Wiarton. It also occurs sporadically in the vicinity of Blessington and West Huntington, Hastings County, and in the Ottawa area in Carleton, Lanark and Russell Counties.

This species is found most frequently in rough, well drained pastures on shallow soils over limestone or shale. It also occurs along roadsides and in waste places, frequently in the vicinity of gravel pits. It is absent from cultivated fields even when the adjacent pastures and roadsides are heavily infested. The plants growing in association with *C. acanthoides* are indicative of the poverty of the habitat: *Poa compressa*, *Verbascum thapsus*, *Echium vulgare*, *Rumex acetosella*, *Hieracium florentinum*, *Cynoglossum officinale*, *Rudbeckia hirta*, etc.

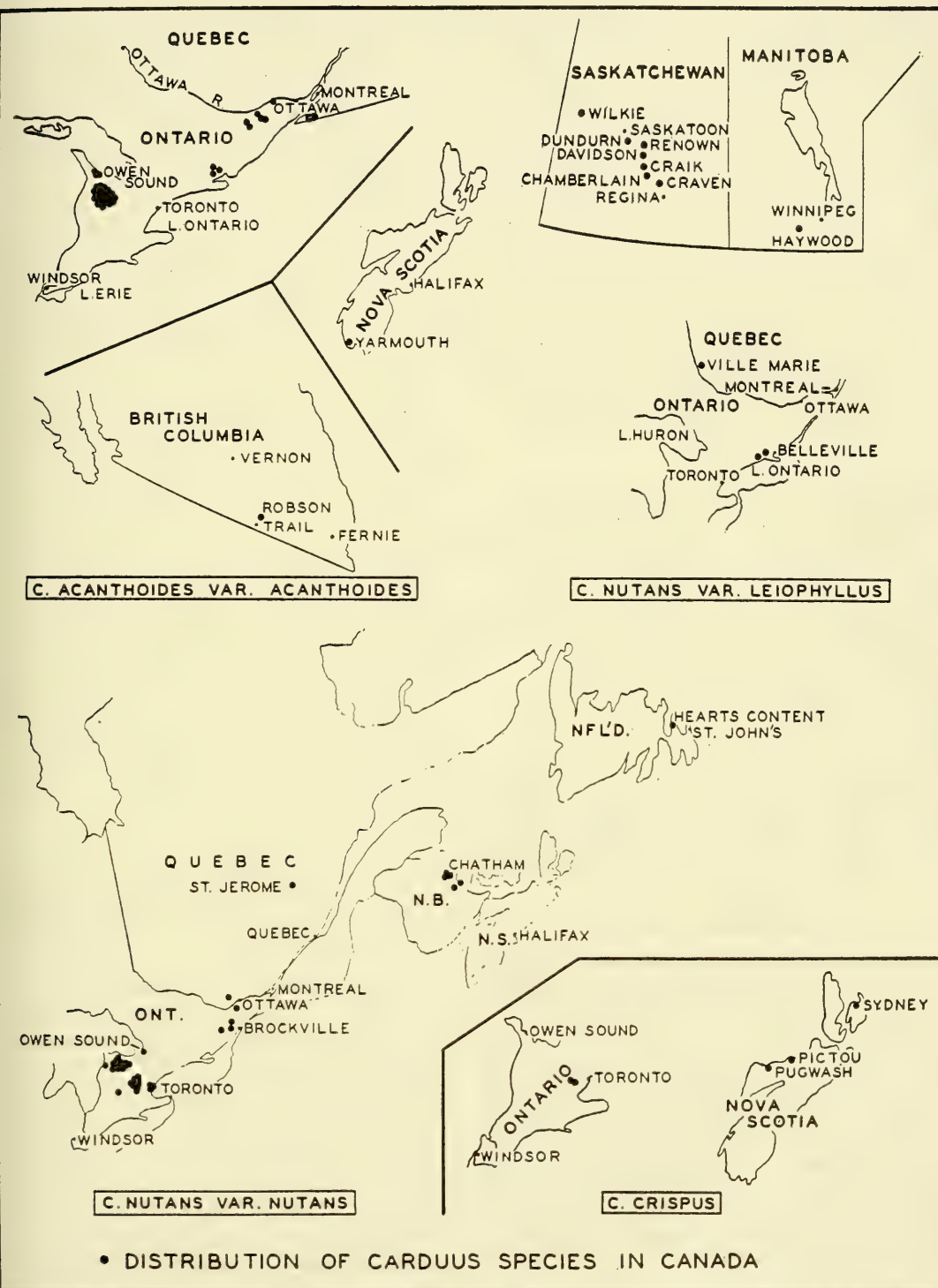
Specimens examined:

C. acanthoides L. var. *acanthoides*

NOVA SCOTIA: Yarmouth, roadsides, waste places and ballast heaps, 1920, Long and Linder 22918 (GH) (CAN).

QUEBEC: ½ mi. NW of St. Agnes de Dundee, Dundee Twp., Huntington Co., small patch in waste lot, gravelly sandy soil over rock, 1952, Bassett and Hamel 2513; 1½ mi. E. of St. Armand Station, St. Armand West Twp., Missisquoi Co., small patch in pasture field, shallow sandy loam over rock, 1952, Bassett and Hamel 2677.

ONTARIO: There are 31 Ontario collections in the DAO herbarium. To conserve space only representative specimens, usually the

Maps showing distribution of *carduus* species in Canada.

first collection, for each area are given. South of Ottawa, 1909, *Groh 1069*; Metcalfe, 1934, *Woods*; Blessington, Hastings Co., 1943, *Groh 2037*; Almonte, Lanark Co., 1945, *James*; West of Durham, Grey Co., heavy in closely grazed pasture, 1947, *Dore and Senn 47-495*; 5 mi. NW of Wiarton, Albermarle Twp., Bruce Co., in old pasture, 1948, *Frankton, Bassett and Dore 826*; 5 mi. W of Kemble, Grey Co., heavy infestation on rocky, shallow soil, 1949, *Senn, Lindsay and Mulligan 4941*; ¼ mi. NE of Flesherton, Artemisia Twp., Grey Co., heavy in pastures and waste places and along roadsides, gravelly sand, 1952, *Mulligan and Moore 967*.

BRITISH COLUMBIA: 3 miles west of Robson, lot 3260, plants up to 12' high in orchard on side of hill, 1952, *Kynaston 37*.

C. acanthoides L. var. *acanthoides* f. *albiflora* (L.) Gross

ONTARIO: 5 miles W. of Kemble, Grey Co., flowers pure white, scattered plants among the more common purple flowered plants, 1949, *Senn, Lindsay and Mulligan 4939*; ¼ mi. NE of Flesherton, Artemisia Twp., Grey Co., scattered plants of white coloured form among the more common purple flowered plants, 1952, *Mulligan and Moore 968*.

C. acanthoides L. var. *acanthoides* f. *ochranthus* Wallr.

ONTARIO: 3 mi. NW of Wiarton, Amabel Twp., Bruce Co., shallow soil in old pasture, less common than the purple coloured plant (about 1 in 100), creamy yellow coloured flowers, 1948, *Frankton, Bassett and Dore 822*.

Carduus nutans L. var. *nutans* —
the nodding thistle

The nodding thistle occurs in Newfoundland, New Brunswick, Quebec and southern Ontario (see Figure and citations at the end of this section).

The first reference to the presence of the nodding thistle in Canada was made by Fowler (1878). He reported the plant as spreading from Ballast at Chatham, New Brunswick. In 1947, Rouleau (1947) listed it as an addition to the flora of Quebec. Collections and observations in 1951 have shown the nodding thistle to be quite common in the Lac St. Jean area of Quebec.

This species is included in Rouleau's preliminary list of the plants of Newfoundland and the islands of Saint-Pierre et Miquelon

(1949). The list is based on specimens filed in the Gray Herbarium, and the University of Montreal Herbarium. All the specimens of *Carduus* in these two herbaria were examined. A specimen, *Arsene 477 (GH)*, collected in 1902 on the island of Saint-Pierre was the only collection of the nodding thistle seen from the area covered by Rouleau's list, thus the collection from the Avalon Peninsula, *Bassett 617*, is the only known record for *C. nutans* in Newfoundland.

As with *C. acanthoides*, *C. nutans* is of more frequent occurrence in Ontario than in the other Provinces. It is sporadic in southern Ontario, reaching its greatest concentration in Wellington County, from Guelph to Acton.

This species is weedy in pastures, along roadsides and in waste places and like *C. acanthoides* will not withstand cultivation. The pastures where it usually occurs are quite hilly, with good drainage, poor plant cover and shallow soil. In many pastures this species is found with *Poa compressa*, *Verbascum thapsus*, and *Echium vulgare* but it is also often accompanied by plants indicative of better soils: *Erigeron strigosus*, *Polygonum convolvulus*, *Rumex crispus*, *Cirsium vulgare*, *Cirsium arvense*, *Taraxacum officinale*, *Tragopogon pratensis*, and *Ambrosia artemisiifolia*. *C. acanthoides*, was found towards the top of the knolls and *C. nutans* at or near their bases.

Specimens examined:

C. nutans L. var. *nutans*

NEWFOUNDLAND: Near Heart's Content, east side of Trinity Bay, Avalon Peninsula, occasional on clay soil over rock along roadside, 1949, *Bassett 617*.

NEW BRUNSWICK: Bass River, 1875, *Fowler*; Chatham, 1926, *Groh*; Chatham, along road near sea, 1931, *Victorin, Germain & Jacques 44, 834 (CAN) (MT) (GH)*; 3 mi. S Chatham, roadside, 1945, *Dore and Gorham 45-551 (DAO) (MT)*; Rexton, Kent Co., waste place, 1951, *Anderson 1657*.

QUEBEC: Wakefield, in pasture on the Pêche River, 1903, *Macoun 60, 636 (CAN)*; 1¼ mi. NE of St. Jerome, Lac St. Jean Co., along #55 highway, scattered plants in sandy loam pasture, 1951, *Bassett & Hamel 2082*; St. Jerome, Lac St. Jean Co., along highway #55, very abundant in waste lot and scatter-

ed along roadside for about 2 miles, 1951, *Bassett & Hamel* 2066; Ste. Croix, Caron Twp., Lac St. Jean Co., sandy loam pasture field, 1951, *Bassett & Hamel* 2135 and 2136.

ONTARIO: There are 23 Ontario collections in the DAO herbarium. To conserve space only representative specimens, usually the first collection, for each area are given. Tavistock, Oxford Co., 1920, ———; Branchton, Waterloo Co., in pasture field, 1940, *Montgomery* 759 (DAO) (GH); Malakoff, Carleton Co., Marlborough Twp., along roadside, 1941, *Minshall & Zinck* 73; Preston, Waterloo Co., on limestone, 1947, *Groh* 3281; ½ mi. NW of Waverly, Simcoe Co., Tay Twp., a few plants in waste field, gravelly sand, 1950, *Bragg & Bassett* 177; 4½ mi. W of Milton West, Halton Co., several patches in pasture, 1951, *Mulligan & Lindsay* 817; Rockwood, Wellington Co., very common in poor pastures and on abandoned land from Guelph to Acton, 1951, *Mulligan & Lindsay* 857; 7 miles S of Singhampton, Simcoe Co., in stoney pasture, 1951, *Mulligan & Lindsay* 875; near Otter Lake, 15 mi. SE of Smiths Falls, Leeds Co., shallow limestone pasture, 1951, *Mulligan & Dore* 909; 3½ mi. N of Durham, Grey Co., on loam soil in pasture with good grass cover, 1952, *Mulligan & Moore* 978; 2 mi. SW of Ceylon, Grey Co., *Artemisia* Twp., growing at edge of gravel pit, 1952, *Mulligan & Moore* 989.

Carduus nutans L. var. *leiophyllus* (Petrovic) Arenes —

the glabrous nodding thistle

The glabrous nodding thistle occurs in Quebec, Ontario, Manitoba and Saskatchewan (see Figure). It is rare in Quebec, Ontario, and Manitoba. The largest single infestation in these three Provinces consists of about fifty plants.

Specimens of this variety have been seen from the following Saskatchewan locations: Craven, Chamberlain, Craik, Davidson, Dundurn and Wilkie. All these stations with the exception of Wilkie are on the Canadian National Railway line from Regina to Saskatoon. Wilkie is on a continuation of the same line running west from Saskatoon. This distribution indicates that the railway was the means of dissemination. The Argentine plant illustrated and described by Cabrera (1941) appears to be this variety. It is conceivable that this thistle was introduced into Saskatchewan in rape seed of Argentine origin.

Fraser *et al* (1944) in their revised, annotated list of the plants of Saskatchewan give three locations from *C. nutans* L.: Craik, Davidson, and Renown. All three sites should probably be referred to as sites for *C. nutans* var. *leiophyllus*. Davidson and Craik are known sites for this variety and Renown is a relatively short distance from known stands of this plant.

Two United States specimens of this taxon are in the DAO herbarium: IDAHO, 4 mi. N of Henry, Caribou Co., common for several miles, 1951, *Senn, Frankton and Gillett* 5694; MONTANA, vicinity of Nine Pipes Reservoir, roadside, 1951, *Harvey* 4434. These collections together with those from Saskatchewan suggest that this plant may occur sporadically over a wide area in Western North America.

Specimens examined:

C. nutans L. var. *leiophyllus* (Petrovic) Arenes

QUEBEC: Ville Marie, County of Temiscamingue, 1951, *Sirois* (DAO) (MBG).

ONTARIO: 4 miles W of Norwood along route # 7, Peterborough Co., only one plant in old pasture, 1948, *Frankton, Bassett and Dore* 630; ¾ mi. E of Roslin, Conc. 9, Lot 3 & 4, Hastings Co., Tyendinaga Twp., about 25 plants on top of well drained rocky knoll in pasture, 1952, *Mulligan and Paxton* 952.

MANITOBA: 2 mi. W of Haywood, a single plant growing in the grassy sod on broad highway allowance, 1950, *Dore and Breitung* 12727.

SASKATCHEWAN: Davidson, open prairie, about 4' tall, 1943, *Podratz* (DAO) (TRT); no location given, open waste land, *Rayner* (TRT); E of Chamberlain, 1 mi. N of highways 11 and 2, plants up to 4' high, in roadside infestation, 1948, *Bibbey* 22; SW of Wilkie, pasture field, 1949, *Garrett* 62; 5 mi. SE of Davidson on highway 11, few plants for 2 or 3 miles, 1949, *Frankton* 982; Craven, Lake Centre District, at junction point of Long Lake Valley and Qu'Appelle Valley, about 20 plants covering a few square rods in neglected old sweet clover field and along fence, on hillside, 1951, *Boivin & Dore* 7567; Dundurn, waste land, 1951, *Russell* 4118; Davidson, roadside, plant 4' tall, 1951, *Ledingham* 1232.

C. nutans L. var.

A specimen of *C. nutans* in the National Herbarium, Ottawa, cannot be satisfactorily determined as either var. *nutans* or var. *leio-phyllus*. It is mentioned here as an indication that this species occurs in British Columbia. The collection is *Eastham 12,263*, Alexis Creek, Chilcote, 1944.

Carduus crispus L. —
the welted thistle

The welted thistle occurs in Nova Scotia and Ontario. Macoun (1884) stated that the plant was found sparingly in the streets of South Sydney, Cape Breton, and on ballast heaps at Pictou. He also cited a location on the west side of Courtney Bay, St. John, New Brunswick (Hay). Roland (1947) referred only to the earlier Macoun report at South Sydney. Specimens have been seen from South Sydney, Pictou, and Pugwash, Nova Scotia, but no specimens were seen from St. John, New Brunswick.

Specimens examined:

C. crispus L.

NOVA SCOTIA: Pictou, on ballast, 1883, *Macoun (GH) (MT)*; Pictou, on ballast heaps, 1883, *Burgess (TRT)*; Pictou, 1885, *Millman (TRT)*; Sydney, Cape Breton, on streets, 1894, *Robinson and Schrenk (GH)*; Pugwash, waste land, 1924, *Fassett 2292 (GH)*; Pugwash, 1935, *Groh*.

ONTARIO: Inglewood, Peel Co., in fields, 1904, *Cosens (TRT)*; Snelgrove, Peel Co., 1907, *White 72, 310 (CAN)*.

Hybrids (*Carduus acanthoides* var. *acanthoides*
X *carduus nutans* var. *nutans*)

In Grey County, these varieties grow together in the same pastures and apparently hybridization is in progress. Complex hybrid swarms have been observed at a number of locations in this area. Numerous collections were made in 1952 and data for a preliminary study of the hybrids were accumulated at that time. Detailed studies are now in progress on this material.

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OBSERVATIONS AT A WHIP-POOR WILL'S NEST ¹

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DURING the summer of 1946 a series of observations were made at a Whip-poor-will's nest (*Caprimulgus vociferus* Wilson) found near Brule Lake in Hunter Township, Algonquin Park, Ontario. Information on the nest site, incubation, development of the young and behaviour of the young and adults was obtained.

The eggs were discovered on June 20 when an adult was flushed from a slight depression in the leaf-mat of the forest floor in a stand of copse-growth red maple (*Acer rubrum* L.) where the tree canopy was almost complete, except for a few small holes through which the sunlight penetrated with full intensity.

DEVELOPMENT OF YOUNG

On July 2 at 3:30 p.m. it was found that both eggs had hatched but since the nest was not visited on July 1, the exact time of hatching of each egg is not known. The incubation period is 19 to 21 days (Terrill, 1938; Bent, 1940; Raynor, 1941). This would place the laying dates at about June 14.

From July 2 to 18 the nest was visited almost daily for the purpose of weighing and studying the development of the young, which were marked with indelible ink to facilitate identification. The weights obtained, the calculated daily gain and the total gain are presented in Table 1.

The initial weighing on July 2 revealed that there was a difference of 1.6 grams between the birds. It is not known whether or not this discrepancy indicates that Bird 2, the heavier one, hatched on July 1, while Bird 1 hatched a day later. Fowle (1946) found that in the case of two nestling Eastern Nighthawks (*Chordeiles minor* (Forester)) the birds hatched on successive days and that by the second day the older one was 1.3 grams heavier than the other. In the present case, the birds made unequal total gains during the first 11 days. Bird 1 gained 29.9 grams and Bird 2 gained 32.1 grams, suggesting a slightly unequal distribution of food to each of the young.

1) Received for publication Oct. 5, 1953.

Table 1. GROWTH OF YOUNG WHIP-POOR-WILLS — July 2-18, 1946

Time of observation	Approx. no. elapsed hours	Total weight		Daily gain		Total gain	
		Bird 1	Bird 2	Bird 1	Bird 2	Bird 1	Bird 2
July 2	3:30 p.m.	5.4	7.0	0	0	0	0
July 3	3:15 p.m.	6.8	9.5	1.4	2.5	1.5	2.5
July 4	4:30 p.m.	9.1	11.9	2.3	2.4	3.7	4.9
July 5	7:00 p.m.	12.2	15.2	3.1	3.3	6.8	8.2
July 6	5:45 p.m.	15.2	18.2	3.0	3.0	9.8	11.2
July 7	5:00 p.m.	17.5	22.4	2.3	4.2	12.1	15.4
July 8	1:45 p.m.	21.6	26.4	4.1	4.0	16.2	19.4
July 9	3:00 p.m.	23.5	28.3	1.9	1.9	18.1	21.3
July 10	2:30 p.m.	25.2	31.8	1.7	3.5	19.8	24.8
July 11	3:00 p.m.	29.6	33.7	4.4	1.9	24.2	26.7
July 12	3:10 p.m.	32.4	35.8	2.8	2.1	27.0	28.8
July 13	11:30 a.m.	35.3	39.1	2.9	3.3	29.9	32.1
July 14	not checked						
July 15	6:30 p.m.		34.8		—4.3		
July 16	6:30 p.m.		33.9		.9		
July 18	9:30 a.m.		46.1		12.2		

Table 2. MOVEMENTS OF YOUNG WHIP-POOR-WILLS

Date	Time	Approx. hours	Approx. hours since last observation	Distance in feet	Total distance in feet
July 2	3:30 p.m.	0	0	0	0
3	3:15 p.m.	24	24	0	0
4	4:30 p.m.	49	25	0	0
5	7:00 p.m.	75	26	0	0
6	5:45 p.m.	98	23	12	12
7	5:00 p.m.	121	23	10	22
8	1:45 p.m.	142	21	17	39
9	3:00 p.m.	167	25	18	57
10	2:30 p.m.	191	24	22	79
11	3:00 p.m.	214	23	3	81
12	3:10 p.m.	238	24	20	101
13	11:30 a.m.	257	19	0	101
14	NO OBSERVATIONS				
15	6:30 p.m.	312	55	63	164
16	6:30 p.m.	336	24	45	209
18	9:30 a.m.	375	39	43	252

Table 1 shows that both birds gained steadily in weight until July 13, about 255 hours after the observations began. The nest was not visited on July 14, but on July 15 Bird 1 had disappeared. The weight losses recorded between 257 and 336 hours for Bird 2 may be related to the first attempts at flying. On July 16 (336 hours, 15th day), it was seen to fly strongly for several yards. Raynor (1941) states that the young under his observation could not fly when 12 days old and Terrill (1938) says that one of his birds flew a few yards when 15 days old. Daily gains increased more or less steadily up to 142 hours (July 8) after observations began. No explanation in the sudden decline in gains between 142 hours and 191 hours can be given. The mean daily gain up to 257 hours for Bird 1 was 2.7 grams and 2.9 grams for Bird 2. There was no constant relation between daily gain and total weight.

It might be supposed that heavy rains would interfere with the feeding of the nestlings by the parents, both by making foraging difficult and by reducing the numbers of insects available. There were seven showers between July 2 and July 18, totalling 0.9 inches, and one very severe storm late on the afternoon of July 11 during which 1.07 inches of rain fell, but none of the storms seemed to be related to the daily weight increments.

Feather development proceeded rapidly until by July 16, 15 days after hatching, Bird

2 was observed to fly. When first discovered on July 2, the chicks were covered with a soft reddish-buff down without obvious markings. By July 5, the sheaths of the flight feathers were appearing but there were few signs of feathers elsewhere. On July 7 the longest primary sheaths were 12 mm. and 15 mm. on the two birds respectively, and 4 mm. sheaths were apparent on the tail. At this time also the spinal pteryllae were apparent and what seemed to be developing rectal bristles were appearing around the mouth. On July 9 the primary sheaths were about 20 mm. long on both birds. Ventrolateral pteryllae were beginning to show up, especially anteriorly, and the feathers on the crown and throat were clearly visible. The primary sheaths began to open on July 10 when they were between 25 and 30 mm. long. At this time the tail feathers were 10 mm. long, measured to the tip of the downy termination. The sheaths at the anterior end of the spinal pterylla began to open on July 11 while, at the same time, the feathers of the upper wing coverts were also opening. On July 13 the posterior portion of the spinal tract began to open but no open sheaths could be found on the crown. These latter did not begin to split until July 15, when the remaining chick was 13 days old and presented a "well-feathered" appearance.

On July 16 the chick was seen to fly when the longest primary was about 65 mm. long and the tail about 30 mm.

BEHAVIOUR OF YOUNG

When the chicks were first found on July 2 they were apparently too weak to move about. When handled they emitted a soft "peep". On the ground they remained side by side with their eyes almost closed.

On July 6 the first evidence of active wandering of the young was noted. Subsequently, throughout the period of observation they wandered considerably about the original nest site and over distances shown in Table 2. The whip-poor-wills did not begin to wander at as early an age as did the nighthawks described by Fowle (1946), nor did they make as long excursions. In the case of the nighthawks the first movement was noted three days after the first bird hatched, but in the whip-poor-wills, no excursions were noted until four days after the young were found. Maximum distance moved by the nighthawks was 90 feet in 17.5 hours, while the maximum for the whip-poor-wills was 45 feet in 24 hours. The birds were never observed to move more than a few inches when disturbed and hence it is not known whether the excursions were made in one step or as a series of short movements. The presence of droppings at intermediate locations between the sites where the chicks were actually seen indicates that the movements were made in a series of short excursions.

These observations are similar to those of Terrill (1938) and Raynor (1941) both of whom mention that the young moved by hopping. The latter author mentions that in one case where the young were enclosed behind a wire screen the female appeared to be coaxing them to follow her by a soft calling: "Crummur".

THE ADULTS

Previous to the discovery of the nest, whip-poor-wills had been heard calling in the vicinity since May 22. A bird, thought to be the same one each evening, was heard to call from a building and a large boulder nearby. Generally it started to call from the building and then moved to the boulder. There was a striking regularity in time at which it first began to call. Between May 23 and June 12 it began calling from the

building at almost exactly 8:30 p.m. for seven consecutive nights, thereafter until June 18 first calls were heard either from the building or the boulder between 8:25 and 8:45 p.m. The more or less strict adherence to the hour rather than to fluctuations in the intensity of light suggests that light is not a factor in the initiation of calling.

Three times an adult whip-poor-will was flushed during the day from the shelter of a hazel (*Corylus cornuta* Marsh.) thicket where it apparently roosted about 100 yards from the nest site. Terrill (1938) reports that he repeatedly flushed a male bird from a spot about 400 yards from a nest site. When a parent was incubating the eggs or brooding the young, it was possible almost to touch the bird before it flushed. It made no movement if we stood within a few feet of the nest and when flushed, usually flew to a stump a few yards away where it continued to emit a soft "quirt-quirt" call and loud hiss. Occasionally it flew a few yards from the nest and moved restlessly about on the ground with the wings partially expanded, all the while calling softly and hissing. On no occasion did it fly at the observers.

It is presumed that the young were fed in the evening, during the night or early in the morning since an adult was almost always found brooding the nestlings by day. This is in agreement with the observations of Raynor (1941) who observed the parents feeding the young at night, apparently by regurgitation.

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NEW PLANT RECORDS FROM BATHURST INLET, N.W.T.^{1, 2}

W. J. CODY

DURING the summer of 1951, Mr. W.I. Campbell of the Division of Entomology, Canada Department of Agriculture, while conducting biological studies under the auspices of the Defence Research Board of Canada, made a collection of plants in the vicinity of the Hudson Bay Post of Bathurst Inlet. This post is located near the head of Bathurst Inlet, an indentation of more than 100 miles in length on the arctic coast of Mackenzie District, just west of Coronation Gulf (66° 51'N, 108° 01' W). Included in the collection were a number of species worthy of note.

TRIGLOCHIN MARITIMA L. — in 3-4 inches of running water, 26, July 30, previously known from the Mackenzie River Delta, Great Bear Lake and further south, this collection appears to be an extension of the known range of nearly 300 miles to the northeast.

ALNUS CRISPA (Ait.) Pursh — moist to wet location, growing up to 5 feet high, 69, August 20. Raup's map in Sargentia VI, 1947 shows the nearest localities for this species around Great Bear Lake and at the east end of Great Slave Lake. This collection appears to be an extension of the known range of nearly 300 miles to the northeast.

PARNASSIA PALUSTRIS L. var **NEOGAEA** Fern.—moist sand, 47, August 20. The distribution map given by Raup *l.c.* shows the nearest localities for this species around Great Bear Lake and at the east end of Great Slave Lake. This collection appears to be an extension of the known range of nearly 300 miles to the northeast.

POTENTILLA PALUSTRIS (L.) Scop.—growing in clumps in marsh or swamp, 49, August

20, previously known in the north from the Mackenzie River Delta, Great Bear Lake and Chesterfield Inlet; this collection helps fill in the picture of the northern limit of the species.

PYROLA SECUNDA L.—small solitary plants on moist lichen hummock, 21, July 30; previously known from the Mackenzie River Delta, Great Bear Lake and Chesterfield Inlet; this collection helps fill in the picture of the northern limit of the species.

ANDROMEDA POLIFOLIA L. — very small plants on moist lichen hummock, 17, July 30. According to the distribution map given by Raup, *l.c.*, the nearest collections of this species are from Coppermine, 200 miles to the west, and along Back River, some 80 miles to the south. This collection therefore represents a slight extension of range to the east and north in this area.

VACCINIUM VITIS-IDAEA L. var. **MINUS** Lodd. — dry to moist lichen plateau, 30, July 30. According to the distribution map given by Raup, *l.c.*, this collection represents an extension of range northwards from Back River, some 80 miles to the south.

SENECIO FRIGIDUS (Richards.) Lessing — dry sand under willows, 33, July 30. This is apparently near the eastern limit of main range of the species in Arctic Canada.

Hultén (Fl. Alaska and Yukon 10:1607. 1950, *sub nom.* *S. atropurpureus* ssp. *frigidus*) reported its disjunct occurrence in Labrador and Newfoundland, but the author has seen no specimens from these areas.

The specimens have been preserved in the Herbarium of the Department of Agriculture (DAO), Ottawa.

1) Contribution No. 1302 from the Division of Botany and Plant Pathology, Science Service, Department of Agriculture, Ottawa, Canada.

2) Received for publication October 21, 1953.

NOTES AND OBSERVATIONS

On the Distribution of *Colymbus grisegena holboëllii*. — The error corrected in the following remarks has been noticed by Manning (1952) but his comments are so brief it seems warranted to elaborate on the matter somewhat since the correction shrinks the breeding range of a species, as frequently outlined in the literature, by approximately thirty percent.

In a faunal paper (Payne, 1887) pertaining to mammals and birds observed in 1885 at Prince of Wales Sound, Hudson Bay, the author made the following remarks:

"Red-throated Diver (*Colymbus septentrionalis*, L.) Coxow Esk.: This bird arrived about June 20th and was often seen during the summer.

"One nest only of this bird was seen a little above high-tide mark, and the Eskimo informed me they could seldom be found.

"On August 7th, some fledglings were seen, and all had disappeared by September 28."

In the "Catalogue of Canadian Birds", (Macoun, 1900) the following remarks are made (p. 2):

"Red-necked Grebe. Holboell's Grebe. *Colymbus holboëllii* (Reinh.) Ridgw. 1884.

"This bird arrived in Wales Sound, Hudson Strait, about June 20th, 1885, and was often seen during the summer. (Payne) ..."

Although Macoun does not give a precise reference to Payne, it is obvious that the above mentioned publication of Payne is the source of the words. As a matter of fact Payne does not include *Colymbus grisegena*, the Red-necked Grebe, in his list. It is clearly a slip on the part of Macoun. He inadvertently transcribed a portion of the information from Payne's paper pertaining to the "Red-throated Diver" and placed it under his (Macoun's) caption "Red-necked Grebe". The error has been repeated frequently in the literature.

It seems probable that on the "strength" of the erroneous record given above, other poorly documented records of *Colymbus grisegena* for the far northeast have been accepted. For example, Sabine (Franklin, 1823; p. 692) records the species, on the basis of specimens from "Hudson's Bay". The locality datum is about as specific as saying "the fur country". The specimens may have originated

from Hudson Bay but if so, most probably they were migrants, taken at a low latitude. Also, in the second edition of the Catalogue of Canadian Birds (Macoun and Macoun, 1909) Spreadborough is given as the authority for the statement that the Red-necked Grebe is "common in northern part of James Bay". On the basis of our present knowledge this statement is open to question, particularly if the implication is summer occurrence. The few definite occurrence records of this species for the northeast do not establish breeding status. Occurrences there are more properly described as pertaining to occasional transients. The most northerly of these concerns a specimen obtained by natives at South Bay, Southampton Island, in 1934 (Bray, 1943). Other specimen records are as follows: A specimen in the R.O.M.Z.P., taken at Moose Factory, southern James Bay, in the spring of 1928 by Sam Waller (Baillie and Harrington, 1936); a specimen reported by Hantzsch (1908) from Maggovic (= Makkovik), south central Labrador; and a skin examined by Austin (1932) that presumably was taken at Spotted Island, southern Labrador.

A few northern and interior occurrences in summer will serve to outline normal range limits in the north and east. Porsild (1943) found it to be a common summer resident in the wooded portion of the Mackenzie Delta where it nests. The R.O.M.Z.P. survey party found it nesting at Favourable Lake in 1938 (MS). Mr. A. Cringan, biologist with the Ontario Department of Lands and Forests, observed two pair with small young on Abram Lake, near Sioux Lookout, in June, 1952 (Baillie, 1953). Baillie and Harrington (1936) have recorded a nest from Whitefish Lake, some fifty miles west of Port Arthur, Ontario.

It is difficult to prove negative occurrence, yet a review of recent, pertinent literature gives significant results. Sutton (1932) did not find the Red-necked Grebe on Southampton Island; Clarke (1940) did not find it in the Thelon region; Taverner and Sutton (1934) did not find it at Churchill; Manning (1946) did not find it on the east side of Hudson Bay nor did he include it in the Appendix to Manning (1949) which consisted of a list of the birds of northwestern Ungava. Also Manning (1948) did not list it from the west side of Hudson Bay between Reindeer

and Baker Lakes. Further, Manning and Coates (1952) did not include it among the birds of James Bay, and Manning and Macpherson (1952) did not include it in their report on the birds of the east James Bay coast. The R.O.M.Z.P. field parties have not found the species in summer in the Hudson Bay and James Bay areas.

Obviously the Red-necked Grebe, *Colymbus grisegena* (N. Am. race *C. g. holböllii*) is not a summer bird of the central or north-eastern Arctic. A line drawn from the mouth of the Mackenzie River to Favourable Lake in northwestern Ontario and thence to Sioux Lookout and Whitefish Lake demarcates its northeastward front. There are sporadic breeding records farther east, but well to the south (Speirs, North and Crosby, 1944). The race *C. g. holböllii* is an irregular winter visitor to the southernmost part of west Greenland, the type locality of the form.

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First Record of the Brassy Minnow, *Hybognathus hankinsoni* Hubbs, from British Columbia. — On May 11, 1952 several species of fish were caught in the Stave River near its junction with the Fraser River with a 20-foot minnow seine. Among these was a cyprinid hitherto unrecorded for British Columbia in association with prickly sculpins (*Cottus asper*), brown catfish (*Ameiurus nebulosus*), peamouth chub (*Mylocheilus caurinus*) and black crappies (*Pomoxis nigro-maculatus*). The average length of the strange fish was 5.7 cm. With falling water level due to dry summer weather, part of the Stave River was cut off from the main flow. Evaporation helped diminish the pond to a narrow ditch containing many of the above species of fish which were unable to escape. The water was nowhere over three feet deep and the bottom was soft and muddy. The water temperature was 15° C.

The author returned to the river on September 1, 1952. In the same shallow ditch large numbers of "minnows" were seen swimming in schools. Some of these were taken with a seine and proved to be identical with the unknown fish caught earlier. The average size of this group was 3.7 cm. and they were much more numerous than those taken in May. The water temperature at this time was 23° C.

Several specimens of the fish caught in September were sent to Dr. Carl L. Hubbs at the University of Michigan who identified them as half-grown brassy minnows *Hybognathus hankinsoni* Hubbs.

The capture of this fish in British Columbia is noteworthy in that its recorded range is through much of the Great Lakes region and in the Missouri River system northward to Montana. It has also been recorded in North Dakota, Nebraska and Colorado, but not, to the writer's knowledge, in the Pacific coast states or in Canada west of Ontario. The brassy minnow is known as a bog-water fish, and its appearance in the Fraser River system of British Columbia is therefore surprising. It seems probable that the minnow has been introduced to the Fraser by anglers using and subsequently releasing live bait. The lack of a previous record for the brassy minnow in British Columbia suggests that the introduction has been recent.

The majority of the specimens are now in the Fish Museum of the Department of Zoology, University of British Columbia. Some

are in the Museum of Zoology, University of Michigan, Ann Arbor, Michigan, and others in the Provincial Museum, Victoria, B.C.

The author wishes to thank Dr. Carl L. Hubbs of the Scripps Institution of Oceanography, La Jolla, California, for identifying the fish.

MILES H. A. KEENLEYSIDE,
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British Columbia, Vancouver 8,
Canada.

Unusual Nesting of Great Horned Owls. — That Great Horned Owls (*Bubo virginianus*), in northern latitudes, lay their eggs early in March, is common knowledge. That they sometimes leave the more remote, heavily-wooded areas at nesting time and move into secluded woodlots adjacent to farm-lands, is known to most of us. But when a pair of these impressive, wild creatures moves into the confines of a busy town to set up house-keeping, — that's news. That's what is taking place in the town of Amherst, Nova Scotia, right now. The rude platform upon which the eggs were laid early in March is the remnant of an old nest originally built by crows. It is located about thirty feet up in a large maple tree, directly over Main Street in the center of the town and at the time of this writing (April 15, 1953) contains young owls. Due to much favorable publicity which has been circulated by Amherst's many bird-conscious and nature-loving citizens, the pair has not been molested and hundreds from far and near, have come to see the nest and the sleepy old male which sits all day on his favorite perch about 20 feet above the busy street along which hundreds of cars are continuously passing. Tacked to the trunk of the tree is a conspicuous sign printed on heavily-waxed paper which reads — "WARNING — DO NOT MOLEST THESE BIRDS—By order POLICE". It is the writer's belief that in choosing this unusual nest-site the owls were influenced by the proximity of the rat-infested town dump which is located less than a mile away. All pellets which have so far been picked up near the nest have been found to contain fur and bones of small mammals and nothing else. If any reader of the foregoing has knowledge of a pair of these owls courting danger at nesting time as this pair has done, the writer would appreciate hearing about it.

R. W. TUFTS,
Wolfville, Nova Scotia.

Cerulean Warbler and Blue-gray Gnatcatcher

Nesting in Bruce County, Ontario. — On June 13, 1953 I saw a male Cerulean Warbler, *Dendroica cerulea*, singing in the top of a tree in a 50 acre bushlot of mature hardwood, 10 miles west of Walkerton. On June 18 two males were singing in the same bushlot and on June 27, after many trips and a lot of searching I finally found a Cerulean Warbler's nest. It was about 7 feet from the trunk in a fork on a horizontal branch of a basswood tree about 8" in diameter at the stump and the nest was about 45' from the ground.

On July 3 Mr. Howard Krug of Chesley and Mr. Crawford Skelton of Walkerton accompanied me to the Cerulean's nest and the female was frightened off by hammering the tree with a big stick. This brought the male and he stayed within a few feet of the nest until she settled back on it. The male did not sing while in the nest tree but sang from other trees about 50 yards from the nest. On July 12 the female acted as though incubation was partially completed. On July 19, after a short vacation, I visited the nest but there was no sign of life there. The nest did not appear to be damaged. I spent about an hour and a half in 75 yard radius of the nest but did not see or hear a Cerulean Warbler.

I believe we have another northern nesting record, this one a nest of the Blue-gray Gnatcatcher, *Poliophtila caerulea*, about 12 miles south of Tobermory, Bruce County. This nest was under construction on June 2, 1953 when discovered by a party of four consisting of Mr. and Mrs. Crawford Skelton, my wife and I.

On June 14, 1953 the gnatcatchers were incubating. Mr. Howard Krug of Chesley visited this nest of June 28 and found the birds carrying food to the nest. The nest was saddled on a horizontal limb about 8 feet from the trunk of a red pine, 45 feet from the ground. It was on the lowest limb.

A Prothonotary Warbler was seen by the same party of four about 12 miles west of Walkerton on May 17, 1953. No nest was found. This bird was recorded for Bruce County in 1935.

GEO. A. MOORE,
Box 99, Walkerton, Ont.

Chimney Swift Recovered in Newfoundland. — A Chimney Swift, band No. 52-73420, banded by the undersigned at Junior High

School, 307 E. 3rd Ave., Rome, Floyd County, Georgia, U.S.A. on September 21, 1952 was recovered at Lamaline, Newfoundland on or about June 20, 1953 by Mrs. Thomas J. Cusack; the bird being picked up dead. — GORDON L. HIGHT, JR., P.O. Box 1626, Rome, Ga., U.S.A.

Ash-throated Flycatcher in British Columbia. — On October 7, 1953 through the kindness and assistance of Mr. William Hughes an Ash-throated Flycatcher *Myiarchus cinerascens cinerascens* (Lawrence) was collected in the second growth deciduous and coniferous woods adjoining the bank of the North Arm of the Fraser River near Marpole, B.C.

The bird proved to be an adult male in heavy and doubtless much delayed moult. The outer pair of rectrices were still enclosed in the sheath for about one third of their length.

This is apparently the first record of the Ash-throated Flycatcher in British Columbia. —KENNETH RACEY, Vancouver 14, B.C.

The occurrence of the Pleistocene wolf *Canis dirus* in the Rocky Mountains of Central Alberta. — On July 27, 1945, Dr. J. Hatter and I were crossing the Castleguard Icefield, at the head of the river of the same name in Banff National Park, Alberta. Part way across we stopped to adjust our packs and while doing so noticed, lying in a narrow trail of overburden, the right lower canine tooth of a large carnivore.

Later comparison with all modern North American carnivores led to the conclusion that the tooth belonged to one of the Pleistocene Canids. The specimen #1505 in the University of British Columbia Museum of Zoology mammal collection was sent to Dr. R. A. Stirton of the Dept. of Palaeontology at the University of California for comparison with their extensive series. There it was identified as representing *Canis (Aenocyon) dirus*.

The tooth has an overall length of 71 mm., of which the crown height on the posterior margin measures 26.7 mm. Antero-posterior diameter of the root at its broadest point is 17.4 mm. and of the crown at the gum line 13.7 mm.

This is believed to be the northernmost record of occurrence for the species in North America. — I. McT. COWAN, Dept. of Zoology, University of British Columbia, Vancouver 8, Canada.

REVIEWS

Keeper of the Stream. By Frank Sawyer; subtitle "*The Life of a River and its Trout Fishery*" published by Adam and Charles Black, London 1952, IX, 211 pages, one illustration, index 2 pages. Distributed by the Macmillan Company of Canada \$4.00.

Frank Sawyer, now head river keeper to the Officers' Fishing Association has lived with a stretch of the Avon River in Wiltshire for many years and in his book he recounts fascinating observations and stories from his experiences on this river.

The frontispiece photograph of the author bears the caption "To me a river is like a picture painted by a great artist; there is so much more in it than meets the eye of the casual observer". The text sets forth, in very interesting and carefully considered detail, much of the information about a stretch of river and its complex of life that goes largely unnoticed by both the casual observer and the ardent angler.

Frank Sawyer probably had little or no training in aquatic ecology but as a result of patient and careful observation, much thought, and a real love for the river and its creatures, he has worked out life history details and behaviour patterns in a way that would do great credit to an advanced student of river ecology. His feeling for the life around him and the interrelation of species is so well considered that he realizes fully the good qualities of some of the predators which take his trout and he manages them, when necessary, with the same care he gives to the trout. It is only recently that predator management in other areas has been done with such clear knowledge of cause and effect and such a true appreciation of the basic problem.

This thoroughly enjoyable book pictures clearly for any reader a most attractive stretch of the Wiltshire Avon. Reading it, every serious angler will relive some of the thrills of past successes while the novice will begin to understand the reasons for his failures. Angler or not, each reader will find in this story passages of humour and of sadness and will sense, in its sincerity, a rare harmony between author and subject which derives from the relation of an expert angler to trout and other creatures of the river.

The book is attractively presented in clear, easily-read type and is free of distracting

typographical errors. — VICTOR E. F. SOLMAN.

The Birds of New Brunswick. By W. Austin Squires. *The New Brunswick Museum, Saint John, N. B. Monographic Ser. No. 4, 1952, pp. 1-164. (\$2.00).*

With the appearance of this book, New Brunswick becomes the third Canadian province to have a modern and comprehensive account of the birds known to occur, or to have occurred, within its borders.

Introductory material (pp. 3-17) includes a carefully compiled history of ornithological work in New Brunswick as well as concise data on the geography, climate, bird banding, and migration routes in that province. A long list of sources of heretofore unpublished information attests to the thoroughness with which the author has gathered his data. Another source of accurate distributional and seasonal data not overlooked was the considerable number of preserved specimens of New Brunswick birds in other institutions. From a list of seven institutions possessing collections of New Brunswick birds the National Museum of Canada, which was a prolific source of specimen data from the northeastern part of the province, is inadvertently missing.

The greater part of the text (pp. 19-134) is devoted to the annotated list which comprises about 331 forms known to have occurred in the province as well as an additional 23 the New Brunswick status of which is regarded as hypothetical. Data are well organized, succinctly presented, and are excellently documented. The author's obvious cognizance of the need for information of a definite nature is most commendable and we find in this list none of that exasperating vagueness regarding details that characterizes far too many annotated lists. All sources of distributional data appear to have been meticulously examined and the validity of many old records has been carefully re-appraised.

For each species the New Brunswick status is summed up in one opening sentence. This is followed by detailed definite information on local distribution, seasonal occurrence, relative numerical status, and nesting data when these are available for the species that breed there. The few errors noted by this reviewer are not serious. For example, the European Widgeon is called a "casual winter visitor"

although the data, as would be expected, show it to be an autumn transient. The season in New Brunswick of the American Brant is summed up as "August 25 to June 11", erroneously implying that it winters. However, the reader will have noted in the next preceding paragraph that the author made it plain that it does not winter.

The taxonomy is for the most part satisfactory and it is plain that the author went to considerable trouble to supply correct subspecific names. In some cases he was handicapped by lack of specimens as in the Redstart and Yellow Warbler. Breeding populations of these are referred racially to *Setophaga ruticilla ruticilla* and *Dendroica petechia aestiva* respectively which would appear to be questionable particularly for populations in the northern parts of the province.

The book is illustrated by 12 black and white photographs and a map of New Brunswick. There is an impressive bibliography of 19 pages and an index. The author and the New Brunswick Museum are to be congratulated on producing this excellent and much-needed work which doubtless will be the authority on New Brunswick birds for many years to come. — W. EARL GODFREY.

Directory of Organization and Officials concerned with the Protection of Wildlife and other Natural Resources. *Compiled by the National Wildlife Federation, 232 Carroll St., N. W., Washington 12, D. C. 48 pp. 25c.*

This directory, issued July 1, 1953, is the first to be published by the National Wildlife Federation. However, it is the 45th edition of this publication which formerly was compiled by the U. S. Fish and Wildlife Service. Approximately 370 organizations which are concerned with any phase of conservation in both North and South America are listed. The organizations are arranged conveniently according to their geographical location and classed as governmental or non-governmental. The information given under each organization usually includes the address, the names of the principal officers and the name of any regular publication.

The value of such a directory to all interested in wildlife conservation is obvious. A new edition, enlarged and brought up-to-date, is scheduled for publication in July 1954. — R. J. MOORE.

The Eastern Belted Kingfisher in the Maritime Provinces. *By H.C. White. 1953. Fisheries Research Board of Canada, Ottawa; Bull. 97, 44 pp., 17 figs., 1 map. (45 cents).*

This interesting paper sums up the author's investigations, over a period of years, of the food and other aspects of the natural history of the Belted Kingfisher, *Megaceryle alcyon*, in New Brunswick, Nova Scotia, and Prince Edward Island. The contents of more than 1300 food pellets and stomachs were analysed and the economic effects of the feeding thus indicated are discussed. Unusual food items include a water shrew, *Sorex palustris*. Minute adult and larval aquatic insects in stomachs are considered by White to be derived from the ruptured stomachs of ingested fishes and do not indicate, contrary to the interpretations of others, that this kingfisher takes these insects directly. Also discounted are published accounts of feeding on large clams and oysters.

Whether or not the feeding of this bird is detrimental to man's interests has long been controversial. Some, who never heard of a stomach analysis or the complexity of the inter-relationships existing among the fish species concerned, have been quick to condemn it. White's conclusions, based on scientific investigation, are therefore of particular significance and should be read by all interested in the subject. In areas in the Maritimes where young salmon and trout are scarce because of limited spawning places this bird's feeding may be harmful; but in naturally overstocked trout streams and in areas where the numbers of minnows and suckers may compete with salmon, this kingfisher may be beneficial. Because much, if not most, of its feeding is done in areas not frequented by commercially important fishes, and because of its aesthetic value, the author sees no reason why it should not be protected — except at fish-rearing establishments and other places where competent investigations shows it to be detrimental to fishing interests.

Other aspects of the life history of this kingfisher are discussed in less detail but there is interesting information on its local distribution, migration, flights, dispersal, nest and nesting, night roosts, enemies, and feeding.

W. EARL GODFREY.

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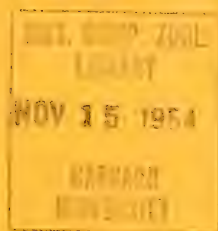
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PLANKTON CRUSTACEA FROM THE THELON WATERSHED, N.W.T.¹

JOHN E. BARDACH²

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THERE are but a few plankton collections from the north-central portion of the American continent. Arctic and subarctic fresh-water plankton has been taken sporadically from lakes along the coast of the Northwest Territories, the Yukon and Alaska (Marsh 1920, Juday and Muttkowski 1915, Juday 1920). Later Hooper (1947) collected mainly in waters accessible from the Alaskan Military Highway at stations in Northern British Columbia, the Yukon Territory and Alaska. At present the work of Wilson (1951) at the Arctic Health Research Center of the U.S. Federal Security Agency is, in part, concerned with the distribution of northern fresh-water microcrustaceans.

During the summer of 1952, I was in the employ of the Canadian Wildlife Service and engaged in a biological investigation in the Thelon Game Sanctuary. On this occasion, 32 plankton collections were made in a region between 63° and 64° 35' Latitude and between 101° and 104° 20' West Longitude between July 6 and August 21st. This report will deal with the crustacea of the plankton found in these collections³.

Methods :

All plankton hauls were made with a conical tow net of #20 bolting silk (54 meshes per sq. inch) by pulling it along the shore or behind a canoe for several hundred feet.

In shallower ponds the hauls were made by wading and the net was dipped in various locations along the shore 10 to 20 times to secure a good representation of the species

present. The surface temperature of the water was taken and a Hellige Pocket Comparator was used to make pH measurements.

Description of Collection Sites :

Travel by canoe facilitated taking the plankton samples in the main river and the lakes connected to it yet the total sampling area was restricted to a belt of about 15 miles extending on either shore of the river, that could be covered on foot. (Figure 1).

"The Thelon River between Dickson Canyon and Aberdeen Lake... flows through a till covered plain of low relief" (Bird 1951). Bordered by shallow banks the river has made a valley of variable depth and width. The river banks rarely exceed 200 feet in height and where the valley widens out the river becomes divided into several channels of swifter and quieter water; islands are formed, covered predominantly by willows, and here and there lakes of several hundred acres are connected to the Thelon proper by shallow water courses which do not seem to dry up throughout the entire summer.

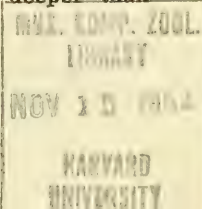
The river valley itself and the valleys of the large tributaries have considerable stands of timber, predominantly black spruce (*Picea Mariana* (Mill.) B.S.P.), (Clarke 1940). The Thelon River thus forms a finger-like extension of the Northern tree limit that points eastward into the otherwise barren uplands of the Keewatin. Most lakes and ponds found beyond the river valley or the larger tributaries are surrounded by typical "Hillock Tundra" (Polunin 1948).

The larger lakes which were accessible by canoe and could be sounded turned out to be surprisingly shallow. Of 10 such lakes, only one exceeded 10 meters in depth, the others were between one and three meters deep. The ponds were rarely deeper than one meter.

1) Received for publication October 29, 1953.

2) Formerly Iowa State Teachers College, Cedar Falls, Iowa.

3) Sincere thanks to J. S. Tener who helped with the collecting, to W. R. Pennak, W. L. Tressler, R. Kiser, M. E. Brooks, H. L. Yeatman, and last but not least, Mrs. M. S. Wilson who very kindly assisted with the identification.



Bird (1951) described sand dunes without a continuous cover of vegetation in the well drained areas between Hornby's Bend and the mouth of the Finnie River (64°N; 102°W). In these sandy outcroppings, often very dunelike in character, with much relief and extending over a few square miles — lakes and ponds are found somewhat less frequently than on coarser till.

The waters with sandy bottoms, here and there bordered by low spruce growth or willow thickets were of the lowest transparency, the most pronouncedly brown color and a pH consistently below 7. Of the 27 standing waters sampled, 7 (seven) belonged to this type.

The lakes in the regions of till or situated in rocky sandstone outcroppings showed a pH above 7; in some cases it even exceeded 8.8, the endpoint of our indicator range. This quality can easily be explained on the basis of a low lime content, shallow depth and the long arctic day with high photosynthetic activity. Usually the zooplankton was abundant and thorough grazing must have contributed to the clear and transparent nature of the water.

The zooplankton fauna of these two discernible types of lakes differed but little; the alkaline waters of the barren uplands had greater numbers of plankters in them and often some large ponds or lakes with gravel bottom throughout contained but few species. Among those, *Diaptomus pibilofensis* was most abundant, and some individuals of *Heterocope septentrionalis* and *Daphnia pulex middendorffiana*, both distinctly Northern forms, were also present. The total number of species collected from all waters of this type exceeded the number from standing waters on sandy substrate but only seven lakes and ponds of the latter type were investigated while 20 of the former were sampled. The exclusive occurrence of *Holopedium gibberum* in acid waters might be expected; whether *Lepidurus arcticus*, *Eurycerus lamellatus*, *Alona costata*, and *Pleuroxus uncinatus* also show preference for coloured and acid water is questionable, although they were, in my collections, only encountered in this environment; it is more probable that this is due to incomplete sampling.

The Thelon River proper :

Five different samples were taken from various sections of the river. The tempera-

ture of the river varied from 12 to 15° C. between July 6 and August 21; the pH between 6.8 and 7.1. The transparency and color of the water was also variable; a Secchi disk disappeared at a depth of 70 cm in sections of low transparency where the flow of the river was slow and much algal debris and humic detritus was suspended in the water. In most locations, however, where the river was deeper than 3 m., 250 cm delimited Secchi disk transparency.

The river samples contained but few species of crustacean plankton but were rich in diatoms, blue-green algae and desmids.

Lakes (over 10 acres) :

Fourteen collections were made in lakes. The temperature ranged from 7° to 17° C., those lakes connected to the river, however, only fluctuated between 14 and 17° C., the coldest waters being found on exposed plateaus. The pH values were between 6.6 and 8.4 (6.6 to 7.6 for lakes connected to the river). The transparency and the color of the water depended on the nature of the shores, the surrounding vegetation and the types of bottom; some were distinctly brown, others very clear and transparent.

Ponds (under 10 acres) :

Thirteen collections were made from such bodies of water. The plankton from these ponds was the most varied both as to numbers of organisms and numbers of species encountered.

Depending on the depth, the exposure and the occasional presence of low trees, the colour and transparency of the ponds varied widely from very clear to dark brown and turbid waters. The temperatures were between 11° and 20° C., the pH ranged from 6.6 to above 8.8, fluctuating in wider limits than in the river or the lakes.

The organisms of the crustacean plankton :

The following system of notations will be used to indicate the distribution of the organisms :

R—occurring in the river proper

S—occurring in lakes and ponds on sandy soil

G—occurring in lakes and ponds of sandstone and gravel regions.

The numbers following the notations signify the numbers of separate collections from each type of environment in which the species was encountered.

The scheme of classification used here is that of Pennak's Freshwater Invertebrates

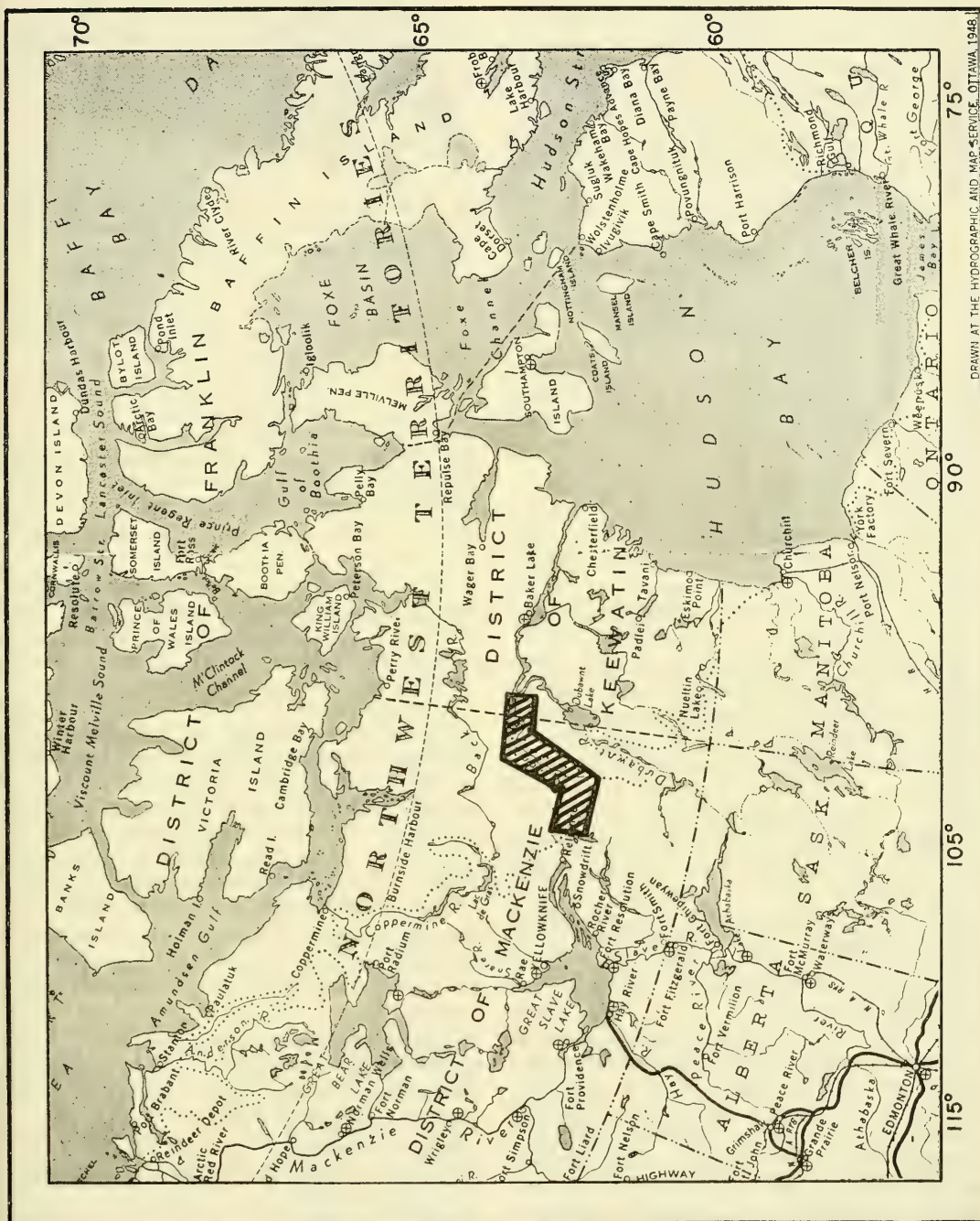


Fig. 1. Map of Northwest Territories, indicating collection sites.

of the United States (1953); specific references are given for forms not included in this work.

EUBRANCHIPODA

Lepidurus arcticus (Pallas) S (1)

After finding this spectacular Notostracan early during the trip we were on the look-out for it but its occurrence is apparently sporadic. It has previously been reported from more Northern locations (Johansen 1922).

CLADOCERA

The Cladocera were the best represented group in the collections. A total of 20 species was found and some of the animals occurred in great numbers, especially *Bosmina longispina* and *B. longirostris*. Only in some collections from small ponds and from one larger lake were Rotatoria more abundant than the Cladocera; *Kellicottia* (*Notholca*) *longispina* (Kellicot) being a representative species and also the most numerous.

Holopedium gibberum Zaddach S (2)

This organism, as was previously mentioned, was only found in waters with a pH less than 7.

Daphnia pulex middendorffiana Fischer S (3); G (6)

This definitely Northern subspecies (Kiser 1951) often with a brownish coloration on the dorsal part of the shell was fairly abundant, occurring more often in ponds than in lakes, yet it was never present in very large numbers.

Daphnia pulex pulex (de Geer) G (1)

Simocephalus vetulus (O. F. Mueller) G (3).

Scapholeberis mucronata (O. F. Mueller) S (2); G (1)

Scapholeberis mucronata, var. *fronte cornuta* P. E. Mueller S (2).

Both forms were numerous in the littoral regions of ponds.

The horned variety had been mentioned by Herrick (1883) who conjectures that the sharp spine on the head (Figure 2) serves to clear away debris or detritus. No previous record from the North American continent is known to me. The Eurasian representatives of the variety "fronte cornuta" have a more pronounced horn — often almost as large as the head of the animal.

Bosmina longirostris (O. F. Mueller) R (1); S (4); G (2).

Bosmina longispina (Leydig) G (4).

Bosmina coregoni Baird G (2).

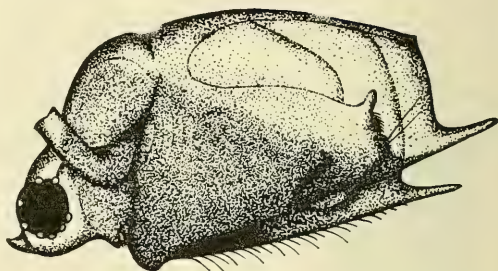


Fig. 2. *Scapholeberis mucronata*, var. *fronte cornuta* P. E. Mueller, drawn after preserved specimens of the Thelon collection.

Kurzia latissima (Kurz) G (1)

Eurycerus lamellatus (O. F. Mueller) S (2)

Acroperus harpae Baird S (1) G (2)

Oxyurella tenuicaudis (Sars) G (1)

Alona guttata Sars S (1); G (1)

Alona costata Sars S (1)

Alona quadrangularis (O. F. Mueller) G (2)

Pleuroxus uncinatus Baird S (1)

Pleuroxus hastatus Sars G (1)

Chydorus sphaericus (O. F. Mueller) S (3); G (5)

This appeared to be the most widely distributed Cladoceran although it did not occur in large numbers.

Polypheumus pediculus (L) G (2)

COPEPODA

The greatest number of copepods were found in the clear, exposed and shallow ponds of the barren lands. These waters often teemed with *Diaptomus pribilofensis*. Very frequently the only American representative of the genus *Heterocope*, *H. septentrionalis*, was found associated with *D. pribilofensis*. (Juday and Muttkowski, 1915).

Cyclops vernalis Fischer R (1); S(5); G(4)

Cyclops capillatus Sars R (1); S (4); G (1)

Cyclops bicuspidatus thomasi Forbes S (5); G (2)

Samplings for cyclopoid copepods may not have been adequate since the presence of other, more littoral forms could well be suspected, (Yeatman 1944).

Epischura lacustris Forbes S (1); G (2)

Diaptomus pribilofensis Juday and Muttkowski S (5); G (7)

Diaptomus ashlandi Marsh P (1)

Heterocope septentrionalis Juday and Muttkowski S (2); G (4)

Canthocamptus staphylinoides Pearse G (3)

Bryocamptus hiemalis (Pearse) G (3)

OSTRACODA

One of the most noticeable features was the almost total absence of Ostracods in the collections. This scarcity was almost certainly due to the collecting method rather than to natural conditions. The bottom material was rarely stirred up nor were plants or submerged stones adequately "combed" to secure a representative sample of this group of crustaceans. It should be noted though that Hooper (1947) does not report any Ostracods in his plankton collections and that the rather extensive collections of D. S. Rawson from Great Slave Lake only contained 5 species of Ostracods, probably for similar reasons⁴.

Limnocythere glypta (Dobbin) S (1); G (2)

AMPHIPODA

Gammarus limnaeus Smith G (2);

The variable color of this species was very striking. Some specimens showed a pale blue, others red, and still others pronouncedly orange colors. The species was not abundant.

Discussion :

Most cladoceran species encountered have a circumboreal distribution, a few, such as *Alona guttata* and *Chydorus sphaericus* are even cosmopolitan (Pennak, 1953). If this report extends the Northeastern range of some of the species, for instance that of *Kurzia latissima* and *Oxyurella tenuicaudis*, this is certainly due to the peculiar distribution of collectors rather than the collected material. The ephippial eggs of Cladocera allow them not only to overwinter in relatively dry situations but also to be distributed by migrating waterfowl with reasonable expectation of success, even if the eggs are out of the water for considerable time.

Calanoid and harpacticoid copepods are probably dispersed overland as resting eggs by adhering to migrating animals also. The cyclopoids, on the other hand, are known to produce resistant cysts in the copepodid stages of development. These might be transferred passively from watershed to watershed.

In a single drainage system it is most likely that active migration plays a major part in the distribution of plankton crustacea. Many lakes and rivers in the Northwest Territories are connected and that appears to be as important a factor in the rather wide and uniform distribution of many forms as any restrictions the climate might impose on them.

In spite of permafrost at the bottom level of most lakes, the ice in this region does not exceed three feet in thickness; in fact, it is usually less than that. Kennedy (1946) has given the following formula for computing the expected thickness of the ice cover in various latitudes and elevations :

$$L_{\max} = 1.15 \phi + 2.58 Z - 43.4$$

where L_{\max} represents the maximum expected thickness of the ice in inches, ϕ the latitude in degrees and Z the elevation in 1000ds of feet. For the region where my collections were made, between 63 and 65° N. at an elevation of 100-300 feet, the expected thickness is 30 inches. Numerous observations by G. H. Zumberge⁵ the most pertinent at the U. S. Airforce Base B.W. 8, from a latitude of 67.5° N. — more than two degrees to North of the Thelon — corroborate the theory. There he never found the ice on fresh-water lakes, even at higher elevations, to exceed 4 feet.

It follows, therefore, that the survival of aquatic animals over the winter is not a problem in the waters of most of the Northwest Territories. There are, it is true, a great number of very shallow, temporary pools, which may, in the spring, be connected to more permanent waters and thus be repopulated every season if the resistant stages, eggs or cysts do not withstand winter temperatures, but none of the bodies of water sampled were of this nature. That some water persisted over the winter in the liquid stage was further suggested by the presence of some rooted aquatic plants in most of the lakes and ponds that were around 1 m. deep.

Last, but not least, it should be said that further collecting in the Northern part of the continent can be expected to show that a fair number of crustacean species which have, up to now, only been reported from Europe and Asia, are of truly circumboreal distribution. The appearance of *Scapholeberis mucronata* forma *cornuta* is a case in point.

Summary :

1) The crustacean plankton from 32 collections of the Thelon River region (NWT) was analyzed and the lakes and ponds from which the plankton was taken were described.

2) The Thelon River proper — a large arctic stream of variable flow — is poor in zooplankton though there are portions of the stream where the velocity of flow slows

4) Pers. commun. W. L. Tressler, Jan. 1953.

5) Dept. of Geology, University of Michigan.

down sufficiently to provide a suitable habitat for zooplankton.

3) The species of Cladocera were most numerous but the individual animals never occurred in great abundance.

4) The Crustacean species occurring in greatest numbers was *Diaptomus pribilofensis* (Juday and Muttkowski) — often found with *Heterocope septentrionalis* (Juday and Muttkowski), an association typical of arctic lakes and ponds.

5) Rotatoria were also abundant in the plankton. In smaller ponds, they sometimes outnumbered all other forms; *Kellicottia longispina* (Kellicott), a rotifer, typical of arctic waters, was ubiquitous and most numerous.

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A BOTANICAL SURVEY OF THE CYPRESS HILLS^{1 2}

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INTRODUCTION

THE Cypress Hills, situated in the dry grassland region of southwestern Saskatchewan and adjacent southeastern Alberta, form an elevated plateau and exhibit some of the most rugged and picturesque scenery on the plains of Western Canada. The plateau, separated from the Rocky Mountains to the westward by some 200 miles of prairie, is an area of great phytogeographical interest. A prominent feature of its vegetation is the lodgepole pine forest which covers, to a large extent, the upper part of the northern slopes and main valleys within the plateau. The name "Cypress Hills" is the English translation of "*Montagne de Cyprè*" originally applied to the hills by the early French-Canadian explorers and fur traders, who believed the trees found there to be the same as the jack pine which they called "*Cyprè*" in Eastern Canada.

The Cypress Hills are of particular interest from biological, topographical and geological aspects, as all these features contrast strongly with the surrounding treeless plain.

During July and August, 1947, the author made a botanical survey of the Cypress Hills in conjunction with a study of the flora of southwestern Saskatchewan. He endeavoured to collect one or more specimens of each species represented on the upper slopes and plateau of the Cypress Hills. Most of the collections were made in the portion within Saskatchewan, but several days were also spent in the Alberta portion. In 1949 and 1950, a few days were again spent in the area. The camp sites where collections were made are shown on the map (Fig. 1). Over seventeen hundred collections of plants were made in this area. A complete set is deposited in the herbarium of the Division of Botany and Plant Pathology, Ottawa.

In the appended catalogue of vascular plants, based mainly on these collections, 664 entities are listed. They represent over one-third of the 1536 species listed for Saskatchewan by Fraser and Russell (11). A small number of species collected by others, but not found by the author, are included to make

the list as complete as possible. John Macoun and succeeding botanists visited the area, but no list has previously been published.

PHYSIOGRAPHY AND GEOLOGY

The dominating physical feature of the Cypress Hills is the nearly level plateau which slopes gently to the east and south, covering an area 100 miles long in an east-to-west direction and 15 to 25 miles from north to south. At its western extremity or "Head of the Mountain", the plateau reaches a maximum elevation of 4,810 feet. At the eastern end, it rises abruptly to 400 feet above the level of the plain (Fig. 2), then gradually becomes higher, with a rise of approximately 16 feet per mile until, at the western end, it is 2,000 feet above the plain. On the north and west sides, it ends in a bold escarp, whereas, on the south, it gradually merges into the plain or forms a series of lower benchlands. A significant topographical feature is the numerous coulées or narrow valleys which cross the plateau transversely and give the appearance of a very hilly country (Fig. 5).

The drainage of the hills is mostly to the south and east. The streams on the southern slopes have dissected the plateau to within a few miles of the northern edge; whereas, those on the northern slope have not entrenched southward into the hills for any appreciable distance (12). Frequently the heads of opposite coulées are only a short distance apart. The main streams, Battle Creek and Frenchman River, have water in them throughout the summer but are then only small streams fed by the numerous springs issuing from the hills. Lakes on the plateau are relatively few, the largest being Cypress Lake in the south-central part, Elkwater Lake at the western end, and Loch Levin in Cypress Hills Provincial Park. The hills constitute the most elevated plateau on the plains of Western Canada and form part of the Continental Divide between the waters that flow south into the Missouri River and those that drain north to the Saskatchewan River. Many of the northward flowing creeks, however, comprise part of an interior drainage system supplying a number of non-permanent alkaline lakes on the plain north of the map area.

¹ Received for publication January 6, 1954.

² Contribution No. 1341 from the Botany and Plant Pathology Division, Science Service, Department of Agriculture, Ottawa, Canada.

A striking feature of the topography is the "benchlands" — broad terraces or successive shelves of land, especially pronounced in the valley of Battle Creek (Fig. 3).

Another prominent topographical feature is "The Gap", a broad valley, several miles across and 300 feet deep, extending across the hills from north to south, east of the provincial boundary. Gap Creek, flowing northward, and Oxarat Creek, flowing southward, have their sources in this valley.

Geologically, the beds covering the plateau and known as Cypress Hills Formation, consist of coarse alluvial deposits, 25 to 150 feet in thickness. The material was originally transported from the Rocky Mountains eastward over a broad, gently sloping and nearly flat plain. The formation is a loose conglomerate, comprised chiefly of smoothly worn, river-sorted boulders, cobbles and pebbles, mainly of quartzite, and is interbedded with a hard, grey, coarse sandstone, marl and silt. In many places, the conglomerate is well cemented by a clayey matrix, such outcrops forming resistant ledges that fringe the crests of slopes. The boulders are up to 1 foot in diameter but average considerably less. They decrease in size from west to east, indicating that they were deposited in an eastward flowing current. From this evidence some authorities interpret the present Cypress Hills plateau as originating in Tertiary times as a rocky bed in an enormous stream flowing in a trough from sources in mountain gorges 200 miles to the west. Later, the softer material of the plain, and even the greater part of the river bed itself, were eroded away, leaving the Cypress Hills, with its hard capping of conglomerates, protruding as a high isolated plateau. The strata underlying the Cypress Hills Formation are softer in nature, consisting of shales, silts and fine sands and are subject to rapid erosion wherever exposed. Thus Russell (30) has stated, that "the combination of resistant rock, structural elevation, and north-south watershed are the chief factors that have united to preserve the Cypress Hills as an elevated plateau", adding that "glaciation, undoubtedly, also played an important role, particularly in shaping the northern escarpment and the long southern slope".

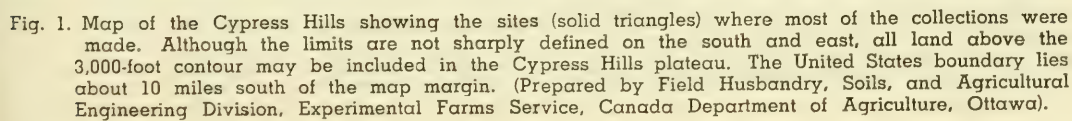
The plateau, then, is the remnant of a valley bottom of preglacial time. The western, or most elevated part, has probably not been glaciated, since Johnston *et al* (18) and

McConnell (24) found no evidence of glaciation on the Cypress Hills above the 4,400-foot contour. This area, about 83 square miles in extent, must have projected as an island, approximately 400 feet above the surrounding ice-sheet. A detailed description of the geology and topography of the region is given by Furnival (12) and Russell and Landes (32).

The hills, although now isolated, are closely related, floristically, to the Rocky Mountains, as indicated by the high proportion of Cordilleran element. It is not improbable that the plateau west of The Gap, which was not glaciated, provided a refuge for the submontane forest and grassland flora to survive to-day as relicts, now disjunct from the area of their origin in the Rocky Mountains. Soil studies indicate that, subsequent to the last glaciation, no continuous forest extended eastward from the Rocky Mountains to the Cypress Hills. This evidence supports earlier views presented by Tyrrell (38) in a paper on the post-glacial climatic changes in north-western Canada where he stated that "... as the glacier retired northward across the Great Plains, a cold climate was succeeded by a warm, dry climate under neither of which conditions forest growth was possible, neither were *Sphagnum* swamps ever formed on them".

According to Fassett (10), the thimbleberry (*Rubus parviflorus*) has spread from the western mountains to the Great Lakes at a time when the climate was sufficiently cool and moist for white spruce (*Picea glauca*) to spread from coast to coast, and south to the Black Hills in South Dakota. He concludes that "... the occurrence of the plant [*Rubus parviflorus*] about the Upper Great Lakes is due, not to the survival of a preglacial flora on nunataks [ice-free islands], but to migration across Canada during a post-glacial cool humid period and subsequent bisection of the range by aridity of the Great Plains".

In an isolated and geographically distinct region, such as the Cypress Hills, one might expect to find endemic plants. However, all species known to-day from these hills occur also in neighbouring regions, especially in the foothills and Rocky Mountains to the west. These species must, then, have entered the Cypress Hills fairly recently. It is evident, therefore, that the Cypress Hills were not isolated long enough for endemics to develop.



Owing to the close proximity of the surrounding Continental glacier and the lack of endemic species, Russell (31) considers it unlikely that a preglacial biota could have survived on the Cypress Hills plateau even if the area was not overrun by the ice. His hypothesis is that the alpine type of flora and fauna reached the Cypress Hills from the south-west in early post-glacial time subsequent to the north-easterly withdrawal of the ice front.

The importance of glaciation and the changes in the climate that followed and governed the spread and survival of plants are undoubtedly of first magnitude. Further investigations of the climatic and geological changes associated with and following the Cordilleran and Keewatin glaciations may reveal a more conclusive explanation of the origin of the Cypress Hills flora.

SOILS

The Cypress Hills conglomerate and other Tertiary sediments are covered by variously textured soils which vary in depth from a few inches to several feet. These surface deposits are generally considered to be of residual or modified residual origin, although it is likely that wind borne material (loess) contributed to their formation. Loam, silt loam and clay loam are the most common textural classes.

A striking feature of the soils is the various color zones which have developed in more or less regular rings in vertical succession as a result of interplay of the overall climatic and biotic factors. In the area under study they include from east to west the brown, dark brown and black zones, all of which have developed under grassland, and the grey wooded soils near the summit and on the north-facing slopes in the black soil zone. Under the grassland the A₁ or surface horizon gradually thickens and becomes darker in color from east to west, corresponding to the gradual increase in precipitation, which in turn is influenced by elevation. In places toward the western end of the plateau the black topsoil is up to 10 inches in thickness. Here the contrast between the black soils and the adjacent grey wooded soils developed under forest is quite marked, inasmuch as the latter have only a thin layer of black topsoil above a distinct grey leached layer.

The correlation between the vegetation and soil type is of particular interest. There is also a close relationship between vegeta-

tion and topography. Precipitation, which increases from east to west, markedly influences the grassland composition across the different soil color zones that have developed on the plateau. The relationship between the vegetation and soil profile of the region reflects the moisture conditions that have prevailed in past centuries.

Soil surveys in the area have been made by Mitchell *et al* (25) covering the Saskatchewan side, and by Wyatt *et al* (39) covering the Alberta side.

CLIMATE

The climate is of the variable continental type, somewhat modified locally by the sheltering hills and forests. It is characterized by long cold winters and short warm summers. Wide and often rapid fluctuations of temperature occur between day and night and from day to day, in all seasons. During the winter low temperatures prevail, most of the precipitation comes as snow, and the ground remains frozen for four or five months or even longer. Persistent snow cover serves as an effective protection to plants in winter. The growing season, then, is relatively short, but during it the days are comparatively long, bright and moderately warm. The nights are almost invariably cool. The prevailing winds are westerly. The most typical winds are warm, dry Chinooks from the south-west and cooler winds from the north-west.

Precipitation and temperature during the growing season are the major factors in plant development. Approximately 50 per cent of the total precipitation occurs in the four months from May to August. Of this amount June receives the largest proportion. Weather records kept for a period of 13 years, 1919 to 1931, by the Dominion Forest Service at Battle Creek Ranger Station, situated in the black soil zone, show that the lowest annual precipitation was 13.39 inches in 1919 and the highest, 30.51 inches in 1927. The average over that period was 18.5 inches. The monthly precipitation for the same period during the growing season averaged: May, 2.00; June, 3.28; July, 2.15; August, 2.05; totaling 9.48 inches for the four months. The average monthly temperature was: May, 46.7°; June, 54.4°; July, 59.4° and August, 56.9°F., or 54.4°F. for the four summer months. Extreme low (winter) temperature was -47°F. and extreme high (summer) was 91°F. The mean annual temperature is 36°F³.

³ Figures supplied by the Dominion Forest Service, Calgary, Alberta.

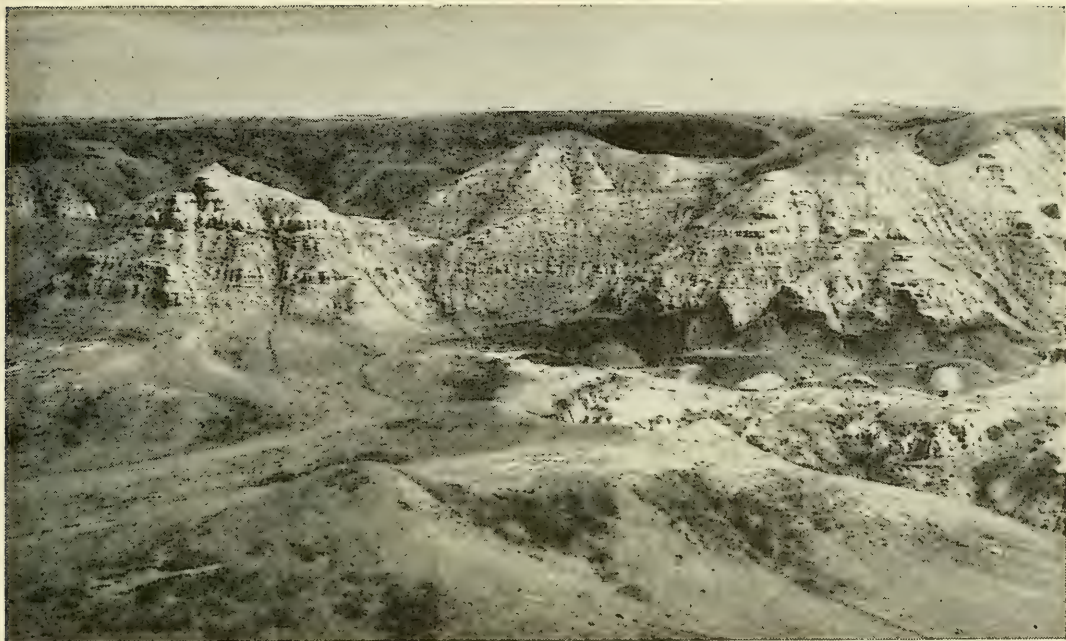


Fig. 2. Aerial view of escarpment of the plateau near Eastend, Sask. Erosion here has cut deep ravines into the soft sedimentary rocks and created a panorama of some of the most rugged and picturesque scenery on the plains of Western Canada. (Photo by M. Kesterton, Saskatchewan, Department of Natural Resources and Industrial Development, Regina).



Fig. 3. Battle Creek Valley near the centre of the plateau, one mile east of Fort Walsh. Willow and poplar thickets interspersed with coniferous woods occur on the bottomlands and on protected slopes. *Stipa-Agropyron* grassland occupies the exposed slopes and the benchland in the distance. (Photo by G. M. Furnival, National Museum of Canada, Ottawa).

In comparison, at Swift Current, on the plain about 100 miles to the northeast, the lowest annual precipitation was 9.94 inches in 1931 and the highest 20.37 inches in 1927. The average was 13.22 inches annually. The lowest (winter) temperature on record was -47°F. in 1929, and the highest (summer) was 102°F. in 1931. The mean annual temperature is 38°F.^4 .

Lower precipitation and greater evaporation during the summer are the chief climatic factors responsible in rendering the plains surrounding the Cypress Hills treeless. Records indicate that evaporation there exceeds precipitation (4, 6, 17). As far as the writer is aware, no evaporation measurements have been made in the Cypress Hills to permit a comparison with the surrounding areas. However, in the Cypress Hills, owing to the greater precipitation and shorter growing season with lower summer temperature, evaporation is undoubtedly considerably less. The rate of evaporation determines the effectiveness of precipitation for plant growth, and is in turn dependent upon wind velocity, relative humidity, and temperature. On the north-facing slopes there is less evaporation and consequently more moisture; also, the temperature is somewhat lower than on the sunny slopes. On the south-facing slopes conditions are drier and hotter. Consequently, the northern slopes are forest-covered while the southern are grassland.

Precipitation from thunder clouds, while usually local and erratic, supplies a considerable portion of the moisture during the summer months. Occasionally during lightning storms prairie and forest fires are started. Perhaps the Great Fire which swept the plateau in 1886 was started in this way.

The Cypress Hills, owing to their greater elevation and coolness, receive considerably more rainfall than the surrounding plains. It is chiefly by virtue of this greater precipitation that the Hills form an oasis in a relatively dry region, a forested island in a sea of grassland.

The seasonal conditions vary greatly from year to year. Extreme variability is one of the most important characteristics of the precipitation. The influence of an early or late spring is frequently felt throughout the entire growing season. Growth of aspen poplar may begin as early as April 21 or as

late as May 15, but on the average this tree begins to leaf out by May 9 and is in full leaf by May 18. The length of the frost-free season also varies from year to year. Freezing temperatures as low as 26°F. may occur any time during the summer months. During the 13-year period 1919-1931, there were six years with no month free of frost, and the estimated average number of days with no frost was 49. The average number of days with 4° of frost or less was 92 and, with 6° or less, 115.

Low temperatures occurring in late spring after growth has begun are particularly damaging to young plant growth, killing flowers and foliage. The following are low (late spring) records: May 5, 1929, 24°F. , and May 27, 1947, 18°F. When the writer arrived in the Cypress Hills in the latter part of June, 1947, there was still evidence of the damage caused by the frost of May 27.

In certain years, however, this elevated area escapes late spring frosts which affect the surrounding lowland, because of temperature inversions. A. C. Budd⁵ has kindly provided the writer with the following important observations made at Swift Current: "A severe frost (17°F.) occurred on the night of May 22, 1949, and a less severe one (24°F.) on the following night. At this time most fruit trees and bushes were in full bloom or setting fruit. The effect of this frost was so severe that a number of species showed little, if any, recovery by the end of May, whereas, in the Cypress Hills on May 26 and 27, it was noted that plants had escaped frost damage and that Saskatoons (*Amelanchier alnifolia*), pin-cherries (*Prunus pensylvanica*), and hawthorn (*Crataegus* spp.) were in full bloom."

At this latitude (between 49° and 50°N.), the average length of day, sunrise to sunset, for the four summer months, May to August, is 15.5 hours. The longest day, June 21, has 16.2 hours, and during the four summer months there is a total of 1,164 hours of daylight. The average number of cloudy days is 47 for the whole year and 7 for the four summer months⁶.

High winds are frequent, especially in spring and autumn, but their velocities are usually less than on the surrounding plain. They are prevailing south-western and are

⁵ Range botanist, Dominion Experimental Station, Swift Current, Saskatchewan.

⁶ Figures supplied by the Dominion Observatory, Department of Mines and Technical Surveys, Ottawa, Canada.

⁴ Figures supplied by the Field Husbandry Division, Experimental Farm Service, Ottawa, Ontario.

usually warmer than those from other directions. Owing to high insolation during the summer, strong winds are locally prevalent during the daytime, but the nights are relatively calm.

Warm, dry, south-westerly winds, called "Chinooks", bring unusually high temperatures for short intervals, varying from a few hours to several days. Their influence is felt far across the interior plains. Their most significant effect in winter is that they rapidly melt the snow, causing thaws without floods. In summer, they dry and preserve the standing grass — making it accessible to livestock during the winter "thaws" — without seriously impairing its quality as fodder. Trees, however, are more seriously affected. The foliage is injured and the cambium layer on their windward side may be killed, thus permanently injuring them and, in time, causing their death. Chinook winds have probably played an important part in bringing about the treelessness of the south-western plains (14). In a letter dated May 28, 1950, H. A. Parker⁷ kindly supplied the following notes: "In 1924 a general partial reddening was apparent in the Cypress Hills on the pole stands of lodgepole pine. The severity of the injury on the south-west side and the absence of injury in protected areas indicate that the winds played a part. The writer is now of the opinion the injury was due to the Chinook winter weather".

One day in January, 1948, R. S. Mackey⁸, while on patrol in the Cypress Hills, noted a change of 56°F. within a six hour interval. A Chinook wind had arisen during the night. At 5 a.m. the temperature was 36°F. Shortly afterwards, the wind changed direction, increased in velocity and by 8 a.m. the temperature had dropped to -10°F.; by 11 a.m. a blizzard was raging and the temperature was down to -20°F.

In winter, aspens around the periphery of the groves or to the leeward of hills are buried in deep snow drifts. Subsequent thawing frequently causes young trees to be bent and broken by the settling mass. Damage to aspens is also quite noticeable after a heavy snowfall accompanied by mild weather. Many of the young trees become so bent that they never recover an upright position.

CHANGES CAUSED BY FIRE AND OTHER FACTORS

In addition to the climatic complexities affecting the vegetation, a number of other factors are of significance. They include the following, arranged in order of importance: (A) fire, (B) grazing, (C) mowing, (D) logging, (E) beavers, and (F) rabbits.

(A) Fire, whether started by man or by lightning, undoubtedly is an important factor and has been emphasized by a number of observers (1, 2, 6, 8, 27, 29). It is well known that the climate of the Great Plains favours grassland, as the precipitation is not sufficient to support tree growth under natural conditions. Prior to settlement of the prairie, fires were undoubtedly more widespread and frequent than since. Drummond (8) in 1855-6 stated: "Those who have observed the almost yearly occurrence in almost every part of the prairie country of great fires, sweeping sometimes over immense stretches of country and of the effects of forest fires... can readily suppose that such fires have been an important factor in rendering the prairie largely treeless and that, aided by the light rainfall and dry atmosphere, they have gradually widened the areas originally burned until the areas have attained their present extent". Borchert (2) writing more recently, interprets the situation more cautiously "... the grassland climates favour fire, just as they favour grass whether there are fires or not".

Moss (26) observed that fire has been a very important factor in preventing the aspen (*Populus tremuloides*) from invading and replacing the grassland in central Alberta. The entire forested area of the Cypress Hills has been under Government supervision as a forest reserve since 1911⁹, during which time fires have been controlled as far as possible. In the absence of widespread burning in recent years, the woodland has, to some degree, invaded the grassland.

Extensive forest fires in the past have, no doubt, seriously modified the timbered areas of the Cypress Hills, so that the resulting present forest includes lodgepole pine (*Pinus contorta* var. *latifolia*) and aspen poplar (*Populus tremuloides*) as the commonest types of trees following fire. An outstanding effect of a forest fire in a mature stand of

⁷ Dominion Forester, Calgary, Alberta, formerly supervisor of the Cypress Hills Forest Reserves with headquarters at Battle Creek Ranger Station.

⁸ Ranger, Spring Creek Ranger Station, Thelma, Alberta.

⁹ An area of 18 square miles was first set aside as a forest reserve in 1906 (Revised Statutes of Canada, Chapter 56). Later this law was repealed and the present boundaries of the reserve (Fig. 1), covering 153 square miles, was established in 1911 (Revised Statutes of Canada, Chapter 10).



Fig. 4. Fescue prairie in the Black Soil Zone on the level unglaciated top of the Cypress Hills near west end of the plateau at an elevation of about 4,800 feet. Scattered threes of lodge-pole pine are isolated, probably through their chance survival of recurrent fires. Shrubby cinquefoil and a great variety of flowering herbs are conspicuous in this prairie. (Photo by A. L. Rand, National Museum of Canada, Ottawa).



Fig. 5. Another view of Battle Creek Valley near Fort Walsh, showing rough topography and abrupt transition from grassland on the exposed slopes to woodland in the hollows and on sheltered slopes. (R.C.M.P. photo).

pine is the immediate growth of seedling pines with very few aspens and spruce (*Picea glauca* var. *albertiana*). The seedling pines gradually thin out with age. The aspen is favoured over pine in moist sites, and after light fires it has the advantage in its ability to regenerate from root sprouts. Evidently the course of succession is not seriously affected. Frequent fires have prevented the development of the spruce forest as a climax formation. As a consequence, the lodgepole pine forest is being maintained as a sub-climax stage. The development of the spruce forest, in the absence of fire during the last 70 years, is illustrated by comparing photographs in a recent article by W. Eggleston (9) showing Fort Walsh in 1878 and as it is to-day. Moss and Campbell (28) point out that successive burning tends to eliminate the fescue grassland. Indirectly, burning tends to favour certain plants, such as fireweed (*Epilobium angustifolium*), raspberry (*Rubus strigosus*), and goldenrods (*Solidago lepida* and *S. serotina*), and these become abundant in burnt-over woods by the removal of shade and competition by other species.

(B) Next in importance is grazing, formerly by buffalo and now by livestock. E. T. Seton (35) remarks: "There is indeed little doubt that [by grazing] the buffalo have helped to extend the prairies". Buffalo wallows are still in evidence in the Cypress Hills. Livestock, especially cattle, tend to graze mainly in the valleys which provide, in addition to grazing, water and shelter. Grazing tends to increase the rate of water run-off and contributes to the denudation and desiccation of the Cypress Hills. Changes in the grassland formation caused by grazing within historic times are very significant and will be discussed further under grassland communities.

(C) Mowing is largely confined to the benchlands and higher parts of the plateau where grazing is less extensive. The effects of mowing tend to keep down shrubby cinquefoil (*Potentilla fruticosa*), locally called "buck brush", and young aspens (*Populus tremuloides*) around the periphery of the groves.

(D) Logging operations remove the mature spruce trees, making room for younger trees to develop. Also, thinning out close stands of young lodgepole pine aids the remaining trees to grow more rapidly in height and diameter.

(E) Beavers are numerous and play an important part in conservation, preventing rapid run-off and erosion. The water impounded by the many dams (beaver ponds) built by these animals has a marked influence on the vegetation in valleys, killing established plants and creating habitats for aquatics.

(F) Girdling of young aspen trees by snowshoe rabbits, as pointed out by Bird (1), is probably important during the peak of their fluctuating cycles.

VEGETATION

Two main types of vegetation are present: grassland which occupies the greater part of the region, and forest restricted to the northern slopes and some of the valleys within the plateau. The transition from one to the other is often abrupt and is especially impressive as one approaches the Cypress Hills from the north. Here the grassland of the plains makes contact with the coniferous forest at approximately the 4,200-foot contour. However, deciduous woods and thickets of shrubs follow down the moist sheltered coulees to form finger-like projections for a considerable distance out into the plain. Where the topography is irregular, groves of woodland are dispersed through the grassland, giving the landscape a parkland aspect (Fig. 3 & 5). A complex of environmental factors must be responsible for the distribution of these distinctive vegetation types, but moisture conditions, both in the soil and in the air, would appear to be of prime importance.

THE GRASSLANDS

The greater portion of the plateau is treeless and covered with a luxuriant growth of herbaceous plants and low shrubs, with grasses predominating. Seasonally, some of the broad-leaved herbs, often called "forbs", as they come into bloom, become so conspicuous as to obscure the grasses and temporarily, at least, give the appearance of dominance. Macoun (22, p. 192) in 1882 vividly described the vegetation as follows: "The flora of the Cypress Hills is very remarkable and differs in many respects from that of the plains... the plateau and upper slopes have the features of the Rocky Mountain flora and both alpine and boreal species here find a home.

"The grasses of the plateau were of the real pasturage species and produced an abundance of leaves and were so tall that for miles at a time we had great difficulty in forcing our way through them.

"As we proceeded westward over the plateau, it becomes more elevated and other species began to take prominence notably *Lupinus argenteus* and *Potentilla fruticosa*, and covered miles of country to the exclusion of other species and so as both grew about eighteen inches high and had a bushy habit, the whole country for a day's travel was either blue or yellow or both as either prevailed or were intermixed. In all my wanderings, I never saw any spot equal in beauty to the central plateau of the Cypress Hills". Macoun (22, p. 252) further states: "No better pasture is to be found in all the wide North-West than exists in these hills..."

The grassland varies greatly in character and composition from place to place, but, in general, only two of the main associations recognized by ecologists are represented.

Mixed-grass Prairie (*Agropyron-Stipa* Association)

The grassland on the eastern part of the plateau (at elevations of 3,300 to 4,000 feet) and extending westward almost to Cypress Hills Park is composed of the "mixed-grass" species characteristic of much of the whole Canadian Prairie (6).

The dominant grasses are *Agropyron dasystachyum* and *Stipa comata*. Characteristic associated species of grasses and grasslike plants are *Koeleria cristata*, *Agropyron smithii*, *Calamagrostis montanensis*, *Poa interior*, *P. secunda*, *Carex obtusata*, and *C. heliophila*. Species of forbs form denser societies in some places, depending on exposure, soil, and moisture conditions, or seasonally become more conspicuous, flowering at different periods and lending color to the landscape from early spring to autumn (6, 7). Chief among these are *Pulsatilla ludoviciana*, *Hymenoxys richardsonii*, *Eriogonum flavum*, *Penstemon procerus*, *Oxytropis spicata*, *Potentilla pensylvanica*, *P. hippiana*, *Antennaria aprica*, *Petalostemon purpureus*, *Psoralea argophylla*, *Eriogonum caespitosus*, *Aster commutatus*, *Astragalus striatus*, *Artemisia forwoodii*, and *Achillea millefolium* ssp. *lanulosa*. Shrubs include *Rosa arkansana* var. *suffulta* and *Juniperus horizontalis*.

Grazing, especially overgrazing during periods of prolonged drought, has altered the original mixed-grass prairie to a large extent. Old ranchers say that the growth of grass is not nearly so tall and dense as in Macoun's day. With overgrazing, many of the above species decrease and pasture sage (*Artemisia*

frigida), purple cactus (*Mamillaria vivipara*) and spiny opuntia (*Opuntia polycantha*) increase.

The most xeric conditions are to be found on south-facing slopes, where erosion has exposed the softer underlying rock formations. Characteristic species of the sparse vegetation in these habitats are *Stipa viridula*, *Oryzopsis hymenoides*, *Rhus aromatica* var. *trilobata*, *Stenotus armerioides*, *Juniperus horizontalis*, *Petalostemon candidus*, *Chrysothamnus nauseosus*, *Oenothera flava*, *Artemisia cana*, *A. longifolia*, *A. dracunculoides*, and *Helianthus petiolaris*.

Fescue Prairie (*Festuca scabrella* Association)

The fescue grassland extends at an elevation of approximately 4000 to 4800 feet (Fig. 4) from the central part of the plateau to the western end. It covers the highest parts of the plateau not occupied by forest. In contrast with the eastern end, the grassland vegetation here is taller, more luxuriant and almost entirely different in floristic composition. This dissimilarity is the result of the greater amount of precipitation which the western half of the plateau receives. The effectiveness of this precipitation for plant development is enhanced by a lower mean temperature and a lower evaporation rate than on the adjacent grassland.

Rough fescue grass (*Festuca scabrella*), sometimes also known as bunch grass, is the dominant species in this association, occasionally forming pure stands. Associated grasses, also common, are *Danthonia intermedia*, *Agropyron subsecundum*, *Helictotrichon hookeri*, *Festuca idahoensis*, *Koeleria cristata*, *Poa canbyi*, and *Poa interior*. Grasses present but of minor importance include *Agropyron dasystachyum*, *Danthonia californica*, *Stipa spartea* var. *curtiseta*, and *S. columbiana*.

A large number of forbs and low shrubs characterize this association which in their respective seasons of flowering turn the fescue grassland into a veritable flower garden. The spring flowering aspect includes a considerable show of *Pulsatilla ludoviciana*, *Astragalus agrestis*, *Ranunculus rhomboideus*, *Cerastium arvense*, *Geum triflorum* var. *ciliatum*, *Potentilla concinna*, and *Claytonia* spp. In late June and July, the two most prominent plants are the blue lupines (*Lupinus argenteus*) and the yellow-flowered shrubby cinquefoil (*Potentilla fruticosa*). Each forms masses of color sometimes covering acres of ground. Northern *Hedysarum* (*Hedysarum alpinum* var. *ameri-*

canum), also common on the plateau east of Spring Creek Ranger Station, gives the landscape a pinkish tinge. Additional forbs of importance in the fescue grassland, arranged in approximate order of their abundance, are *Achillea millefolium* ssp. *lanulosa*, *Aster laevis*, *Arnica fulgens*, *Gaillardia aristata*, *Potentilla gracilis*, *Oxytropis gracilis*, *Ranunculus cardiophyllus*, *Heuchera richardsonii*, *Solidago nemoralis* var. *decemflora*, *S. decumbens* var. *oreophila*, *Perideridia gairdneri*, *Zizea aptera*, *Anemone multifida* var. *globosa*, *Thalictrum venulosum*, *Delphinium bicolor*, *Galium boreale*, *Agoseris glauca*, *Dodecatheon pauciflorum*, *Zygadenus elegans*, *Erigeron glabellus*, and *Campanula rotundifolia*. In grassland bordering pine woods *Castilleja mineata* is common.

Along fire-guard roads perennial forbs are among the first plants to colonize, preceding the grasses. These roadsides develop colorful perennial borders of a great mixture of flowering forbs and shrubs from the adjacent grassland where, due to lack of competition and greater soil moisture content, they produce blooms of unusual size. The most notable of these colorful species are Blanket Flower (*Gaillardia aristata*), Bluebell (*Campanula rotundifolia*), Smooth Aster (*Aster laevis*), and Prairie Rose (*Rosa arkansana* var. *suffulta*).

A. C. Budd informed the writer that the yield of fescue hay on the Cypress Hills plateau was approximately 985 pounds per acre. According to Clarke *et al* (4), the forage yield on the surrounding plains ranges from 251 to 524 pounds per acre.

THE FOREST

The forest has its greatest development on the north-facing escarpment, extending from the top of the plateau down to approximately the 4,200-foot contour. Forest growth on the south slope is present only on the Alberta side, is less extensive and does not reach as low an elevation as on the north slope. Battle Creek is fairly heavily wooded but otherwise very little tree growth occurs within the plateau. Lodgepole pine (*Pinus contorta* var. *latifolia*) forms the predominant tree growth, with aspen (*Populus tremuloides*), Alberta spruce (*Picea glauca* var. *albertiana*), and balsam poplar (*Populus balsamifera*) occurring as local dominants. Northwestern white birch (*Betula papyrifera* var. *subcordata*) and Manitoba maple (*Acer negundo*) are localized mainly to the vicinity of Birch Creek Ranger Station.

These are the only tree species, the first three form practically pure stands which will be described separately and they also form mixed stands of various proportions.

For administrative purposes the forest has been divided into three areas, the West, the Centre, and the East Block, each separated by several miles of grassland (Fig. 1). The forest cover in the West and the Centre Block is primarily lodgepole pine and aspen, with spruce and balsam poplar of lesser importance. In contrast, the East Block is essentially deciduous, an aspen forest confined to the north slope below the level of the plateau. Northwestern white birch, balsam poplar and Manitoba maple are also present, but the only conifers observed were one or two isolated individuals of lodgepole pine.

Lodgepole Pine Forest (*Pinus contorta* var. *latifolia* Association)

The lodgepole pine forest extends west from Cypress Hills Provincial Park to the west end of the plateau, at an elevation of from 4,200 to 4,800 feet (Fig. 7), the most extensive stands being in the West Block.

Close stands of lodgepole pine are characterized by very sparse undergrowth of relatively few species. Shrubs of *Salix scouleriana*, 8 to 16 feet high, occur sporadically. The ground is carpeted with dwarf and prostrate shrubs, 4 to 6 inches high, growing in the thin layer of pine needles. The most important species are *Arctostaphylos uva-ursi*, *Linnaea borealis* var. *americana*, and *Vaccinium caespitosum*. Herbaceous plants include *Hieracium albiflorum*, *H. canadense*, *Arnica cordifolia*, *Trisetum wolfii*, *T. spicatum*, *Danthonia spicata*, *Calamagrostis rubescens*, and *Pyrola asarifolia*. Insufficient sunlight is responsible for the sparse undergrowth, consequently, in openings or around the margins, there occurs a denser growth of *Rosa acicularis*, *Shepherdia canadensis*, *Spiraea lucida*, *Calamagrostis canadensis*, *Aster conspicuus*, and *Clematis verticillaris* var. *columbiana*.

The forest has been subject to successive fires, the most destructive occurring in October, 1886. This fire, apart from a few unburned patches of timber, appears to have covered all the hills. Lesser fires have occurred since. Today the trees are straight, slender, averaging from 6 to 10 inches in diameter and from 30 to 50 feet in height, forming dense stands. Though theoretically subclimax, lodgepole pine forest actually has

climax characteristics. No young growth of spruce was observed coming up in the pine stands so that the progression to climax is extremely slow. However, G. S. Cranston¹⁰ informed the writer as follows: "I have observed three or four places where young spruce have taken quite a hold amongst the lodgepole pine. Two places in particular the regeneration is practically all spruce. Young spruce is also gradually taking over in the aspen forest, but very slowly".

Aspen Woodland (*Populus tremuloides* Association)

Extensive aspen woods are found chiefly along the northern slopes. These woods form a belt that extends, in the East Block, from the edge of the plateau down to approximately the 3,400-foot contour. This belt becomes narrower toward the west. In the Centre and West Blocks it follows, in general, along the lower edge of the pine forest.

In the aspen woods three lower layers are recognizable. Under the leafy canopy formed by the aspen trees, there is a layer composed of tall shrubs several feet in height and usually widely spaced. The more important are *Amelanchier alnifolia* and *Salix bebbiana*, but *Salix scouleriana* and *Prunus virginiana* var. *melanocarpa* are also present. The next layer is composed of shrubs and herbs two to four feet in height and comprises the chief undergrowth, often forming extensive thickets. Characteristic species of this stratum are *Lathyrus ochroleucus*, *Geranium richardsonii*, *Bromus marginatus*, *B. ciliatus*, *Elymus glaucus*, *Vicia americana*, *Agropyron subsecundum*, *Calamagrostis canadensis*, *Schizachne purpurascens*, *Symphoricarpos albus*, *Rosa acicularis*, *R. woodsii*, and *Aster ciliolatus*. Others of lesser importance are *Actaea rubra*, *Apocynum androsaemifolium*, *Ribes oxycanthoides*, *Epilobium angustifolium*, *Rubus strigosus*, and *Aster conspicuus*. The lowest layer is composed of herbaceous plants up to one foot in height. *Viola rugulosa* is the chief species, but *Fragaria glauca*, *Anemone canadensis*, *Smilacina stellata*, *Rubus pubescens*, *Pyrola elliptica*, and *Arenaria lateriflora* also occur. Low thickets of *Symphoricarpos occidentalis* and *Rosa* spp. generally border the aspen groves and mark the transition to the adjoining grassland.

Aspen reproduces mainly by root-sprouts, giving rise to the characteristic, more or less extensive groves, or "poplar bluffs", which

together with the grassland form a parkland (Fig. 5). These groves commonly form pure stands of timber, other tree species being absent.

In the absence of widespread burning within historic times, the aspen has to some extent invaded the grassland. This is indicated where true black grassland soil is found under aspen woods. Moss (26) has determined that in some parts of Alberta the increase around the periphery of aspen groves by root-sprouts is at the rate of about 15 cm. per year. Fire is a very important factor in counteracting the invasion of the aspen into the grassland, but, although it kills the trunks, regeneration quickly takes place from the roots below ground.

Aspen in groves on exposed sites remain stunted and low in stature, ranging from 15 to 25 feet in height. Their development is retarded by the action of the prevailing strong, desiccating winds which cause injury to the young shoots during the growing season. This factor has given them their "wind-blown" habit — with very branchy tops and irregular trunks frequently with very little under-growth (Fig. 6). Trees growing in sheltered and more favourable situations develop their usual shape and attain a height of 40 or 50 feet, particularly on the north slope.

Although the majority of the species in the aspen woods are closely related to the groves in the foothills to the west, it is of interest that a few characteristic species of the forest to the north occur which were not reported by Moss (26) from south-western Alberta. These are *Aralia nudicaulis*, *Viburnum edule* and *Corylus rostrata*. On the other hand, the following species characteristic of the aspen grove section of central Alberta and Saskatchewan to the north are lacking in the Cypress Hills: *Salix petiolaris* Smith, *Maianthemum canadense* Desv. var. *interius* Fern., *Mertensia paniculata* (Ait.) Don., *Lathyrus venosus* Muhl., *Lilium philadelphicum* L. var. *andinum* (Nutt.) Ker.

Alberta Spruce Forest (*Picea glauca* var. *albertiana* Association)

Alberta spruce shows best development in the cool moist habitats in the vicinity of springs. Especially good stands occur along the brooks forming the headwaters of Battle Creek (Fig. 8). Balsam poplar and aspen are frequently associated with the spruce, but are of secondary importance. As one ascends

¹⁰ Superintendent of Cypress Hills Provincial Park.



Fig. 6. Dense grove of stunted aspens (*Populus tremuloides*) on an exposed site. Prevailing strong and desiccating winds cause injury to the young shoots during the growing season and, consequently, the trees develop a wind-blown habit, with very branchy tops, irregular trunks and very little under-growth.



Fig. 7. Lodgepole pine forest in Cypress Hills Provincial Park. (Photo by W. E. Godfrey, National Museum of Canada, Ottawa).

the valley of Battle Creek to the drier slopes, the spruce forest gives way to lodgepole pine, forming tension lines or admixtures in the transition zone. Sometimes the transition is from spruce to aspen, and then to lodgepole pine on the higher slopes. In other places, the spruce appears to have come up with the lodgepole pine and now is superseding them in height, standing out as spire-like individuals.

On drained and relatively dry soil beneath a close stand of spruce, the ground is often practically devoid of vegetation, but in moister situations there is usually a fair representation of flowering plants, horsetails and mosses. Shrubs 3 to 5 feet high include *Cornus stolonifera*, *Viburnum edule* and *Salix* spp. Lower shrubs and herbs, 2 to 3 feet high, are *Ribes hudsonianum*, *R. lacustre*, *Calamagrostis canadensis*, *Aster oregonus*, and *Actaea rubra*. Plants less than 2 feet high include *Equisetum arvense*, *E. pratense*, *Linnæa borealis* var. *americana*, *Rubus pubescens*, *Cornus canadensis*, *Carex disperma*, *C. concinna*, *Petasites palmatus*, *Mitella nuda*, *Pyrola asarifolia*, *P. secunda*, *Orchis rotundifolia*, *Habenaria obtusata*, *Cypripedium passerinum*, and *Carex gynocrates*. In forest openings *Heracleum lanatum* and *Senecio exaltatus* frequently occur.

Timber of some commercial value occurs within the forest reserves (15). In the spruce forest, trees measuring 40 inches in diameter and having 125 annual rings are not uncommon. Such trees must have escaped the Great Fire of 1886.

RIVER VALLEY COMMUNITIES

The two main valleys, those of Frenchman River and Battle Creek, each have quite a distinct flora. Along the Frenchman River at Eastend, there is a more or less dense tangle of tall shrubbery, composed of *Salix lutea*, *Cornus stolonifera*, *Rosa woodsii* var. *macounii*, *Betula fontinalis*, *Symphoricarpos occidentalis*, and *Clematis ligusticifolia*, with the occasional tree of *Acer negundo* and *Salix amygdaloides*. Here also occurs *Ribes aureum* — the only locality known in Saskatchewan — apparently as a migrant from the south. In other places, the prairie comes down to the river's edge or there merges with wet sedge-meadows. Sheltered in the narrow tributary valleys to the north, aspen and spruce occur as groves of limited size.

In contrast, the vegetation in the Battle Creek valley consists chiefly of stands of lodge-

pole pine, spruce and aspen, interspersed with areas of open grassland. The forest then gradually diminishes from west to east as the valley broadens, until, about one mile beyond Fort Walsh, it disappears altogether. The stream course itself is fringed by shrubby vegetation, composed chiefly of *Salix* spp., *Betula fontinalis*, and *Elaeagnus commutata*, up to 10 or 15 feet high.

Grazing is confined mainly to the larger river valleys, where water and shelter for livestock is provided. Here the effect of grazing has shown as a notable increase in certain unpalatable shrubs and herbs, of which the following are important: *Symphoricarpos occidentalis*, *Salix* spp., *Rosa* spp., *Crataegus* spp., *Prunus virginiana* var. *melanocarpa*, *Geranium viscosissimum*, *Elaeagnus commutata*, *Monarda fistulosa* var. *menthaefolia*, *Achillea millefolium* ssp. *lanulosa*, *Antennaria microphylla*, and *Cirsium undulatum*.

MARSH COMMUNITIES

The marshy vegetation surrounding the pond known as Loch Lomond, near Loch Levin, in the Cypress Hills Park is fairly typical of that around ponds ("sloughs") and lakes in the area. The slopes down to Loch Lomond are wooded with aspen on the east and, on the west, with lodgepole pine. The transition to the marsh is marked by a rather narrow belt of willows (*Salix planifolia*), several feet high. Then along the margin of the pond, in shallow water and on the wet shore-line, the following species are to be found: *Equisetum fluviatile*, *Sparganium multiparticulatum*, *Glyceria striata*, *Scirpus microcarpus*, *Carex pachystachya*, *Juncus saximontanus*, *J. longistylis*, *J. dudleyi*, *Galium trifidum*, *Scutellaria epilobifolia*, *Eleocharis palustris*, *Naumburgia thyrsiflora*, *Mimulus guttatus*, *Cicuta douglasii*, *Geum rivale*, and *Veronica americana*. The most prominent species found in water up to a depth of 2 to 3 feet, extending from near the shore-line and covering the greater part of the marsh, are *Carex atherodes*, *C. rostrata*, *C. aquatilis*, *Glyceria grandis*, and *Glyceria borealis*. Fringing the outer margin of this zone is *Typha latifolia*. Beyond this, out into the centre of the pond, are only submerged aquatics, some with floating leaves. They include *Potamogeton gramineus*, *P. richardsonii*, *Polygonum amphibium*, *Ranunculus aquatilis* var. *divaricatus*, *R. purshii*, and *Utricularia vulgaris* var. *americana*.

Another marshy area, about an acre in extent, in the valley of Battle Creek at Fort Walsh, is circular in outline and fed by a subterranean spring in the centre (Fig. 9). This marsh, in contrast to the one around Loch Lomond, supports a relatively small number of species and a markedly different flora. The primary species here are *Carex aquatilis* and *Scirpus pauciflorus*, which together form a dense mat. Species of lesser abundance are *Carex viridula*, *C. hassei*, *Parnassia palustris*, *Aster junciformis*, *Juncus alpinus*, *Triglochin palustris*, *T. maritima*, and *Carex simulans*. Taller plants standing up above this sedgy meadow are a few scattered bushes of *Salix candida*, 2 to 3 feet high. In the very centre of the marsh, a single dark green clone of *Scirpus validus*, 2 or 3 feet across, is conspicuous. This species and probably also the *Carex aquatilis* represent the sole remnants of a former more aquatic stage in the development of the marsh. The marsh is fringed by a belt or zone of willows several feet high and, beyond this, is the spruce forest. It is evident that the willows are invading the marsh and, eventually, the forest may close in to complete the natural succession.

As might be expected, some variation in floristic composition is encountered in marshy areas from one locality to another. For example, in Elkwater Lake, *Scirpus validus* is common and *Typha latifolia* lacking. At Cypress Lake, both are present and together form the dominant vegetation of its margin.

Other plant communities occur in localized areas, but are of less significance to those already discussed. Some idea of the habitat relationships may be gained from the notes on the species in the appended catalogue.

CORDILLERAN SPECIES REPRESENTED

Numerous Cordilleran species are represented in the forest and grassland on the upper slopes and highest parts of the plateau. Preference for coolness and moisture has restricted many of these plants to the elevated habitats where they form relict communities which have their nearest affinity with those of the Rocky Mountains of south-western Alberta (27) and adjacent Montana (35).

Certain Cordilleran species are rare, being restricted to special habitats on steep gravelly slopes fringing the summit of the plateau, where, due to erosion and exposure, a dense cover of plants has not become established (13). Here a refugium is afforded certain

relict species, including the following: *Festuca idahoensis*, *Arenaria congesta*, *Astragalus vexilliflexus*, *Antennaria reflexa*, *Sedum stenopetalum*, *Erigeron compositus*, *E. radicans*, and *Saxifraga rhomboidea*.

Another type of habitat supporting Cordilleran species takes the form of grassy slopes at the head of ravines (coulées) facing northward. Here spring is considerably delayed by the combined effect of the northern exposure and the accumulation of snow that has drifted off the plateau. Species of this habitat include: *Potentilla diversifolia*, *Ranunculus inamoenus*, *Perideridia gairdneri*, *Stipa columbiana*, and *Carex raynoldsii*.

Following is a complete list, arranged botanically, of the species, 85 in all, that are regarded as comprising the Cordilleran element in the flora of the Cypress Hills: *Juniperus communis* var. *saxatilis*, *Picea glauca* var. *albertiana*, *Pinus contorta* var. *latifolia*, *Alopecurus glaucus*, *Bromus marginatus*, *Calamagrostis purpurascens*, *C. rubescens*, *Danthonia californica*, *Elymus glaucus*, *Festuca idahoensis*, *F. scabrella*, *Hordeum brachyantherum*, *Poa glaucifolia*, *P. nevadensis*, *Stipa columbiana*, *Trisetum wolfii*, *Carex hoodii*, *C. microptera*, *C. pachystachya*, *C. petasata*, *C. raynoldsii*, *C. simulans*, *Juncus ensifolius*, *J. saximontanus*, *Smilacina amplexicaulis*, *Goodera oblongifolia*, *Salix caudata*, *S. drummondiana*, *S. pseudocordata*, *S. scouleriana*, *Betula papyrifera* var. *subcordata*, *Polygonum bistortoides*, *Arenaria congesta*, *A. rubella*, *Actaea rubra* ssp. *arguta*, *Anemone multifida* var. *globosa*, *Clematis verticillaris* var. *columbiana*, *Ranunculus cardiophyllus*, *R. inamoenus*, *R. pedatifidus*, *Thalictrum occidentale*, *Claytonia lanceolata*, *C. linearis*, *Heuchera flabellifolia*, *Saxifraga rhomboidea*, *Sedum stenopetalum*, *Barbarea orthoceras*, *Crataegus columbiana*, *C. douglasii*, *Geum triflorum* var. *ciliatum*, *Potentilla diversifolia*, *Rubus parviflorus*, *Sorbus scopulina*, *Spiraea lucida*, *Astragalus vexilliflexus*, *Lupinus argenteus*, *Geranium richardsonii*, *G. viscosissimum*, *Perideridia gairdneri*, *Leptotaenia multifida*, *Chimaphila umbellata* var. *occidentalis*, *Pteropora andromedea*, *Monotropa latisquama*, *Lithospermum ruderales*, *Mimulus guttatus*, *Synthyris rubra*, *Anaphalis margaritacea* var. *subalpina*, *Antennaria anaphaloides*, *A. corymbosa*, *A. howellii*, *A. obovata*, *A. oxyphylla*, *A. reflexa*, *A. rosea*, *Arnica cordifolia*, *Aster oregonus*, *Erigeron compositus*, *E. droebachiensis*, *E. radicans*, *Senecio exaltatus*, *S. multnomensis*, *Crepis exilis*, *C.*

intermedia, *C. occidentalis*, and *Hieracium albiflorum*.

It may be that even a greater number of Cordilleran species formerly occurred in the Cypress Hills and some have been eliminated due to competition by more aggressive species from the surrounding plains.

Some 40 or more species occurring in southwestern Alberta are not known to be present in the Cypress Hills. These species include the following: *Pinus flexilis* James, *Pseudotsuga taxifolia* (Lamb.) Britton, *Populus trichocarpa* Torr. & Gray, *Balsamorhiza sagittata* (Pursh) Nutt., *Danthonia parryi* Scribn., *Lupinus sericeus* Pursh, *Castilleja sulphurea* Rydb., *Erigeron speciosus* DC., and *Hedysarum sulphureus* Rydb. It seems likely that these species, having presumably reached the east slope of the Rocky Mountains and adjacent foothills since the last major climatic fluctuation, have not been able to reach the Cypress Hills because of the intervening extensive area of semi-arid plains, a natural barrier to their migration.

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SUMMARY

The Cypress Hills are a partly wooded plateau isolated in the grassland plains of southwestern Saskatchewan and adjacent Alberta. Geologically, the plateau is the remnant of an ancient river flat, the surrounding portions of which were eroded away in pre-glacial times to a depth of 2,000 feet at the western end. Glacial and recent erosion has subsequently shaped the plateau and dissected its interior. Its prominent relief in contrast to the surrounding plain presents a barrier to the prevailing winds, which probably accounts for the moister condition of air and

soil on the northern slope creating habitats suitable for the persistence of forest. Five major floristic units are represented: mixed prairie (*Agropyron-Stipa* Association), on the Brown Soil Zone; fescue prairie (*Festuca scabrella* Association), on the Black Soil Zone; a lodgepole pine forest (*Pinus contorta* var. *latifolia* Association), a spruce forest (*Picea glauca* var. *albertiana* Association), and an aspen woodland (*Populus tremuloides* Association), on the Grey Wooded Soil Zone. Marsh communities occupy wet depressions. The vascular flora consists of 664 entities of which a considerable proportion are species of Cordilleran affinity.

ANNOTATED CATALOGUE OF THE VASCULAR PLANTS

In the following catalogue, families are listed in botanical order, and genera and species within them in alphabetical sequence. The number after each citation refers to the collections of the author. Although several collections of a species were often made, only one from the Saskatchewan side of the boundary and one from the Alberta side are given.

Current manuals covering the area are those of Budd (3) and Rydberg (33; 34). Hitchcock's manual (16) was used for the grasses and Mackenzie's monograph (21) for the genus *Carex*. Synonyms have been inserted only where the names used differ from those in these and other published works.

The abbreviations for the herbaria where specimens collected by persons other than the author are preserved, are as follows:

(Can) — National Herbarium of Canada, Ottawa.

(DAO) — Division of Botany and Plant Pathology, Canada Department of Agriculture, Ottawa.

(DAS) — Laboratory of Plant Pathology, Canada Department of Agriculture, Saskatoon, Sask.

(DASC) — Experimental Station, Canada Department of Agriculture, Swift Current, Sask.

(UnA) — University of Alberta, Edmonton.

(UnS) — Fraser Herbarium, University of Saskatchewan, Saskatoon.

The catalogue records 74 families, 264 genera, and 664 species, subspecies or sub-specific entities. Eighteen families are represented by a single species each. The



Fig. 8. Alberta spruce (*Picea glauca* var. *albertiana*) in the valley of Battle Creek. Lower branches are festooned with conspicuous yellow lichens (*Alectoria sarmentosa*).

majority of the species belong to a relatively few families, the six largest, arranged in order of number of species, being as follows: *Compositae* (108); *Gramineae* (83); *Cyperaceae* (53); *Rosaceae* (38); *Leguminosae* (36); *Ranunculaceae* (30). The two largest genera are *Carex* with 43 species and *Salix* with 16 species.

OPHIOGLOSSACEAE

Botrychium lunaria (L.) Sw. Rare; in partial shade on the plateau. Sask.: 4187.

B. virginianum (L.) Sw. Rare; in aspen woods. Sask.: 4715.

POLYPODIACEAE

Cystopteris fragilis (L.) Bernh. (*Filix fragilis* (L.) Gilib.) Scarce; in damp woods. Sask.: 4983. Alta.: 5611.

Dryopteris disjuncta (Ledeb.) Morton (*D. linnaeana* C. Chr.; *Phegopteris dryopteris* (L.) Fée) Rich woods; rare. Alta.: Suicide Coulee, R. G. H. Cormack 370 (UNA).

EQUISETACEAE

Equisetum arvense L. Common along creeks in spruce forest. Sask.: 4240. Alta.: 5556.

E. fluviatile L. (*E. limosum* L.) Occasional in marshes. Sask.: 4211.

E. kansanum Schaff. Frequent on dry clay banks. Sask.: 5472. Alta.: 5260.

E. laevigatum A. Br. (*E. intermedium* (A. A. Eat.) Rydb.) Occasional in moist places. Sask.: 4570. Alta.: 5514.

E. pratense Ehrh. Occasional along springs in spruce forest. Sask.: 4248. Alta.: 5557.

E. prealtum Raf. (*E. hyemale* L. var. *affine* (Engelm.) A. A. Eat.) Common on dry banks and gravelly shores. Sask.: 5163.

E. scirpoides Michx. Occasional along creeks in spruce forest. Sask.: 5063.

E. sylvaticum L. Scarce; in moist woods. Sask.: 4796.

E. variegatum Schl. Frequent along Battle Creek. Sask.: 5019.

LYCOPODIACEAE

Lycopodium annotinum L. Scarce; in lodgepole pine forest. Sask.: Cypress Hills Park, 4482. Alta.: Spring Creek Ranger Station, 5503.

L. obscurum L. (*L. dendroideum* Michx.) Rare; in lodgepole pine forest. Sask.: Cypress Hills Park, 4481.

SELAGINELLACEAE

Selagnella densa Rydb. Abundant on dry exposed hillsides. A subdominant species important in erosion control. Sask.: 4436. Alta.: 5553.

PINACEAE

Juniperus communis L. var. *saxatilis* Pall. (*J. sibirica* Burgsd.; *J. nana* Willd.) Frequent on dry, open hillsides. Sask.: 4865. Alta.: 5614.

J. horizontalis Moench (*Sabina horizontalis* (Moench) Rydb.) Occasional on dry, exposed hillsides. Sask.: 4211. Alta.: 5356.

Picea glauca (Moench) Voss var. *albertiana* (S. Brown) Sarg. (*P. albertiana* S. Brown) Common in valleys. Sask.: 4266. Alta.: 5651. Tree narrowly pyramidal to spire-like in outline; bark rough and flaky; cone scales rounded. Some individual trees (Sask.: 4269, 5480) have sparsely hairy branchlets. A. E. Porsild visited the Cypress Hills in 1951 and is of the opinion (personal communication) that in addition, another Cordilleran race, *P. glauca* var. *porsildii* Raup occurs there. It differs from var. *albertiana* chiefly in its conical or narrowly ovate outline and in its relatively smooth, balsam-like bark beset with resin blisters.

Pinus contorta Dougl. var. *latifolia* Engelm. (*P. murrayana* Balf.) The most abundant forest tree in the Cypress Hills, here at the eastern limit of its range in Canada. Sask.: 4720. Alta.: 5599.

TYPHACEAE

Typha latifolia L. Common in marshes. Sask.: 4787.

SPARGANIACEAE

Sparganium eurycarpum Engelm. Borders of ponds, lakes and streams. Sask.: Cypress Hills, Macoun 28056 (Can).

S. multipedunculatum (Morong) Rydb. (*S. simplex* Huds. var. *multipedunculatum* Morong) Frequent in marshes. Sask.: 4944.

POTAMOGETONACEAE

Potamogeton gramineus L. (*P. heterophyllus* Schreb.) Scarce; in ponds. Sask.: 4792.

P. pectinatus L. Frenchman River. Sask.: Macoun 16466 (Can).

P. richardsonii (Benn.) Rydb. (*P. perfoliatus* L. var. *richardsonii* Benn.) Common in lakes. Sask.: 4600. Alta.: 5278.

P. strictifolius Benn. Common in lakes and streams. Sask.: 4256.

P. vaginatus Turcz. Occasional in shallow water. Alta.: 5277.

Zannichellia palustris L. Common in slow streams. Sask.: 5023.

LILAEACEAE

Lilaea scilloides (Poir.) Haum. (*L. subulata* Humb. & Bonpl.) Mud-flat; border of small slough in parkland; southeast of Elkwater, Alta.: E. H. Moss 9618 (DAO; UnA).

SCHEUCHZERIAEAE

Triglochin maritima L. Common in marshes. Sask.: 5205.

T. palustris L. Common in marshes and along Battle Creek. Sask.: 5021.

ALISMACEAE

Alisma plantago-aquatica L. var. *triviale* (Pursh) Farwell (*A. brevipes* Greene) See Ann. Rep. Comm. Parks and Boulev., Detroit 11: 44. 1900; *Rhodora* 48: 87-88, 1946. Scarce in shallow water. Sask.: 5138.

Sagittaria cuneata Sheld. (*S. arifolia* Nutt.) Occasional in shallow water. Alta.: 5276.

GRAMINEAE

Agropyron albicans Scribn. & Smith Scarce; on dry prairie and hillsides. Sask.: 5342. Alta.: 5532.

A. dasystachyum (Hook.) Scribn. Common on dry open hillsides. Sask.: 4319.

A. inerme (Scribn. & Smith) Rydb. Dry hillside. Sask.: Farwell Creek, Cypress Hills, Macoun 12976 (Can).

A. repens (L.) Beauv. Roadside weed; introduced. Sask.: 4969.

A. riparium Scribn. & Smith Scarce; submontane prairie. Sask.: 14107.

A. smithii Rydb. Frequent in grassland. Sask.: 4969.

A. spicatum (Pursh) Scribn. & Smith Scarce; on dry hillside. Sask.: Sucker Creek, Cypress Hills, Macoun 12970 (Can).



Fig. 9. A marsh in the valley of Battle Creek near Fort Walsh. Tall willows form a zone around the sedge-rush meadow and are invading it. The spruce forest is in the background.

A. subsecundum (Link) Hitchc. (*A. richardsonii* (Trin.) Schrad.). Common on the open plateau. Sask.: 4832. Alta.: 5577.

A. trachycaulum (Link) Malte (*A. tenerum* Vasey; *A. pauciflorum* (Schwein.) Hitchc.) Occasional in the fescue grassland. Sask.: 4331.

A. triticeum Gaertn. Reported from the Cypress Hills by Fraser and Russell (11).

Agrostis exarata Trin. (*A. grandis* Trin.). Scarce; along springs in woodland. Sask.: 4845. Alta.: R. G. H. Cormack 559 (DAO).

A. palustris Huds. (*A. stolonifera* L. var. *compacta* Hartm.). Occasional along creeks. Sask.: 5195.

A. scabra Willd. (*A. hyemalis* of auth., not (Walt.) B.S.P.) Occasional in meadows. Sask.: 4562. Alta.: R. G. H. Cormack 464 (DAO).

Alopecurus aequalis Sobol. (*A. aristulatus* Michx.) Occasional in dried-up ponds. Sask.: 4766. Alta.: 5279.

A. glaucus Less. (*A. occidentalis* Scribn. & Tweedy; *A. alpinus* of Hitchc. Man., not L.). Rare; in damp place; edge of aspen woods. Sask.: Cypress Hills Park, 4629.

Beckmannia syzigachne (Steud.) Fern. (*B. eruciformis* Am. auth., not Host) Occasional in wet places. Sask.: 4592. Alta.: 5289.

Bouteloua gracilis (H.B.K.) Lag. Common on dry hills toward the eastern end of the plateau. Sask.: 5347.

Bromus anomalus Rupr. (*B. porteri* (Coult.) Nash) Common in aspen woods. Sask.: 4801. Alta.: 5542.

B. ciliatus L. (*B. dudleyi* Fern.) Common in aspen woods. Sask.: 5198.

B. inermis Leyss Common along roadsides; introduced. Sask.: 4697.

B. marginatus (Hook.) Buckl. (*B. breviaristatus* Buckl.) Common in thickets and edges of aspen bluffs. Sask.: 4511. Alta.: 5511.

B. pumpellianus Scribn. Scarce; on dry hill-sides. Sask.: 5341. Alta.: 5082.

B. purgans L. Common in aspen woods. Sask.: 4737.

Calamagrostis canadensis (Michx.) Beauv. Common in wet meadows. Sask.: 4591. Alta.: R. G. H. Cormack 522 (DAO).

C. inexpansa A. Gray Occasional in moist meadows. Sask.: 4953. Alta.: 5526.

- C. montanensis** Scribn. Occasional on dry hills. Sask.: 4423.
- C. neglecta** (Ehrh.) G.M.S. (*C. stricta* Beauv.) Occasional in marshy meadows. Sask.: 4951.
- C. purpurascens** R. Br. Under willows along creek just east of Spring Creek Ranger Station, Alta.: 14203.
- C. rubescens** Buckl. Occasional in dry pine woods. Sask.: 5294. Alta.: 5573.
- Calamovilfa longifolia** (Hook.) Scribn. Occasional on dry, open hillsides. Sask.: 5038.
- Catabrosa aquatica** (L.) Beauv. Occasional in brooks. Sask.: 4376. Alta.: 4532.
- Cinna latifolia** (Trev.) Griseb. Occasional in damp shaded places. Sask.: 4683. Alta.: 5616.
- Danthonia californica** Boland. Occasional in the fescue prairie. Sask.: 4436. Alta.: 14202.
- D. californica** Boland. var. *americana* (Scribn.) Hitchc. (*D. americana* Scribn.) Occasional in meadows. Reported from the Saskatchewan side of the Cypress Hills by Fraser and Russell (11). Alta.: 14203.
- D. intermedia** Vasey Common on the open plateau. Sask.: 4399. Alta.: 5570.
- D. spicata** (L.) Beauv. Frequent in pine woods. Sask.: 4655.
- D. unispicata** Munro Moist draw. Sask.: Cypress Hills, J. A. Campbell 11 (DAO).
- Deschampsia caespitosa** (L.) Beauv. Occasional in open meadows. Sask.: 4458.
- Distichlis stricta** (Torr.) Rydb. (*D. dentata* Rydb.) Sask.: by shore of Cypress Lake, Macoun, 13084 (Can).
- Elymus canadensis** L. Occasional along creeks. Sask.: 5247.
- E. condensatus** Presl Rare; opening in woods. Sask.: Fort Walsh, 5197.
- E. glaucus** Buckley Common in aspen woods. Sask.: 4471. Alta.: 5543.
- E. innovatus** Beal Occasional in open woods. Sask.: 4593. Alta.: 5541.
- Festuca idahoensis** Elmer Common on the open plateau. Sask.: 4402. Alta.: 5625.
- F. saximontana** Rydb. Common on dry hills and ridges. Sask.: 4333. Alta.: 14187. This species is probably only a geographical race of *F. ovina* L.
- F. scabrella** Torr. (*F. campestris* Rydb.) Abundant on the open plateau. Sask.: 4232. Alta.: 14193.
- Glyceria borealis** (Nash) Batch. (*Panicularia borealis* (Nash). Occasional in ponds. Sask.: 4578. Alta.: 5274.
- G. grandis** S. Wats. (*Panicularia grandis* (S. Wats.) Nash) Common in shallow water. Sask.: 4530. Alta.: 5284.
- G. striata** (Lam.) Hitchc. (*G. stricta* Scribn.; *Panicularia nervata* (Willd.) Kuntze) Frequent in wet meadows. Sask.: 4490. Alta.: 14200.
- Helictotrichon hookeri** (Scribn.) Henr. (*Avena hookeri* Scribn.) Common on the plateau. Sask.: 4335.
- Hierochloë odorata** (L.) Wahl. Near summit of the plateau south of Elkwater Lake, Alta.: 14192.
- Hordeum brachyantherum** Nevski (*H. nodosum* Am. auth., not L.) See Madrono 10: 1-21, 1949. Occasional in moist meadows. Sask.: 4671. Alta.: 4853.
- H. jubatum** L. Common roadside weed; introduced. Sask.: 4568.
- H. jubatum** L. var. *caespitosum* (Scribn.) Hitchc. (*H. caespitosum* Scribn.) Scarce; in moist meadows. Sask.: 4573.
- Koeleria cristata** (L.) Pers. (*K. gracilis* Pers.) Frequent on dry hillsides. Sask.: 4336. Alta.: 5779.
- Muhlenbergia cuspidata** (Torr.) Rydb. (*Sporobolus cuspidatus* (Torr.) Wood) Occasional on dry hillsides. Sask.: 5396.
- M. racemosa** (Michx.) B.S.P. (*M. glomerata* (Willd.) Trin.) Scarce; on creek bank. Sask.: 5165.
- Oryzopsis asperifolia** Michx. Moist prairie slopes Alta.: Elkwater Lake, J. A. Campbell, June 11, 1936 (DAO).
- O. hymenoides** (Roem. & Schult.) Ricker (*Eriocoma hymenoides* (Roem. & Schult.) Rydb.; *E. cuspidata* Nutt.) Occasional on dry banks. Sask.: 5488.
- Phalaris arundinacea** L. Common in wet meadows. Sask.: 4736.
- Phleum alpinum** L. Frequent in damp meadows. Sask.: 4228. Alta.: 5291.
- Poa annua** L. Introduced weed around cottages in the park. Sask.: 4525.
- P. canbyi** (Scribn.) Piper Frequent on the open plateau. Sask.: 4435.
- P. cusickii** Vasey Sask.: Cypress Hills, J. A. Campbell 21 (DAO).
- P. glaucifolia** Scribn. & Wims. Occasional in aspen woods. Sask.: 5326. Alta.: R. G. H. Cormack 394 (DAO).
- P. interior** Rydb. (*P. rupicola* sensu Fraser and Russell) Common on the plateau. Sask.:

4428. Alta.: 5533. This species is probably not distinct from *P. nemoralis* L.

P. juncifolia Scribn. Reported from the Cypress Hills by Fraser and Russell (11).

P. nervosa (Hook.) Vasey Reported from the Cypress Hills by Fraser and Russell (11). Alta.: R. G. H. *Cormack* 228 (DAO).

P. nevadensis Vasey Sask.: Farwell Creek, Cypress Hills, *Macoun* 13302 (Can).

P. palustris L. (*P. triflora* Gilib.; *P. crocata* Michx.) Frequent in wet meadows. Sask.: 4515.

P. pratensis L. Roadside in pine woods. Sask.: 4468.

P. secunda Presl. Frequent on the open plateau. Sask.: 4445. Alta.: 13756.

Puccinellia airoides (Nutt.) S. Wats. & Coult. (*P. nuttalliana* (Schultes) Hitchc.) Damp shores; uncommon. Alta.: 14188.

Schizachne purpurascens (Torr.) Swallen (*Avena striata* Michx.) Occasional in open woodlands. Sask.: 5570. Alta.: 14199.

Sphenopholis intermedia Rydb. Scarce in wet springy places. Sask.: 8083. Alta.: 14189.

S. obtusata (Michx.) Scribn. Low meadow. Sask.: Eastend, G. F. *Ledingham*, July 23, 1941 (DAO).

Stipa columbiana Macoun Common on hillsides in grassland. Sask.: 4395.

S. comata Trin. & Rupr. Common on the dry eastern part of the plateau, rare toward the west. Alta.: 13723.

S. richardsonii Link Frequent in aspen woods. Sask.: 4571.

S. spartea Trin. var. *curtiseta* Hitchc. Occasional on dry hills. Sask.: 4816. Alta.: 13724.

S. viridula Trin. Occasional in valleys. Sask.: 4985. Alta.: 13725.

Trisetum spicatum (L.) Richt. (*T. subspicatum* (L.) Beauv.) Frequent in pine woods. Sask.: 4317. Alta.: 5578.

T. wolfii Vasey (*Graphephorum wolfii* Vasey; *G. muticum* (Boland.) Greene) Occasional in dry pine woods. Sask.: 4492. Alta.: 5655.

CYPERACEAE

Carex aenea Fern. Occasional in damp meadows. Sask.: 4362.

C. aquatilis Wahl. (*C. substricta* Mack.) Common in marshes. Sask.: 4583. Alta.: R. G. H. *Cormack* 164 (DAO).

C. atherodes Spreng. (*C. trichocarpa* Muhl. var. *aristata* (R. Br.) Bailey) Common in

marshlands. Sask.: 4238. Alta.: R. G. H. *Cormack* 447 (DAO).

C. athrostachya Olney Common in moist meadows. Sask.: 4506.

C. aurea Nutt. Scarce; in moist places. Sask.: 4360. Alta.: R. G. H. *Cormack* 153 (DAO).

C. backii Boott. Occasional on wooded banks. Sask.: 4187.

C. bebbii Olney Common in moist meadows. Sask.: 4361.

C. brevior (Dewey) Mack. Scarce; in moist meadows. Sask.: 5076.

C. canescens L. Occasional in wet shaded places. Sask.: 4345.

C. capillaris L. Occasional in springy places. Sask.: 5127. Alta.: R. G. H. *Cormack* 317 (DAO).

C. concinna R. Br. Occasional in spruce forest. Sask.: 5062. Alta.: R. G. H. *Cormack* 127 (DAO).

C. deweyana Schw. Occasional in aspen woods. Sask.: 4547. Alta.: R. G. H. *Cormack* 306 (DAO).

C. diandra Schrank Common in marshlands. Sask.: 4239. Alta.: R. G. H. *Cormack* 260 (DAO).

C. disperma Dewey Common in spruce woods. Sask.: 4247. Alta.: R. G. H. *Cormack* 60 (DAO).

C. douglasii Boott Damp meadow. Sask.: Cypress Hills, R. C. *Russell*, June 25, 1936 (DAO).

C. eburnea Boott Scarce; in moist woods. Alta.: R. G. H. *Cormack* 160 (DAO).

C. eleocharis Bailey Gravelly hillside. Sask.: Cypress Hills, *Macoun* 10771 (Can).

C. festivella Mack. Common in moist meadows. Sask.: 4585. Alta.: R. G. H. *Cormack* 99 (DAO).

C. filifolia Nutt. Common on dry exposed hills. Sask.: 5354.

C. gynocrates Wormsk. Common in spruce swamps. Sask.: 5110. Alta.: R. G. H. *Cormack* 354 (DAO).

C. hassei Bailey (*C. garberi* Fern. var. *bifaria* Fern.) Rare; in bogs. Sask.: 5203. Alta.: R. G. H. *Cormack* 253 (DAO).

C. heliophila Mack. Common on dry hills. Sask.: 4324. Alta.: R. G. H. *Cormack* 152 (DAO).

C. hoodii Boott Occasional on moist banks. Sask.: 4589.

C. hookerana Dewey Occasional on dry banks. Sask.: 4567.

C. interior Bailey Occasional in wet meadows. Sask.: 4581. Alta.: R. G. H. Cormack 255 (DAO).

C. lacustris Willd. Probably common in marshlands. Alta.: Elkwater Lake, R. G. H. Cormack 258 (DAO).

C. lanuginosa Michx. Frequent in marshlands. Sask.: 4590. Alta.: R. G. H. Cormack 463 (DAO).

C. leptalea Wahl. Common in spruce forest. Sask.: 4716. Alta.: R. G. H. Cormack 316 (DAO).

C. microptera Mack. Occasional in springy places. Sask.: 5321. Alta.: R. G. H. Cormack 407 (DAO).

C. obtusata Lilj. Common on dry hillsides. Sask.: 4334.

C. pachystachya Cham. Common in damp meadows. Sask.: 4355. Alta.: R. G. H. Cormack 123 (DAO).

C. petasata Dewey Occasional on dry, grassy slopes. Sask.: 5343.

C. prairea Dewey Springy place in spruce forest. Alta.: Elkwater Lake, 13718.

C. praticola Rydb. Occasional on the plateau. Sask.: 4459.

C. raynoldsii Dewey Scarce; in wooded ravines. Sask.: 4405.

C. rossii Boott Frequent on shaded banks and in pine woods. Sask.: 4208. Alta.: 5626.

C. rostrata Stokes (*C. utriculata* Boott) Common in marshlands. Sask.: 4526. Alta.: R. G. H. Cormack 330 (DAO).

C. simulata Mack. Common in a marl bog. Sask.: Fort Walsh, 5103. Alta.: R. G. H. Cormack 159 (DAO).

C. stipata Muhl. Common in wet places. Sask.: 4356.

C. sprengelii Dewey Scarce; in aspen woods. Alta.: Elkwater Lake, R. G. H. Cormack 161 (DAO).

C. torreyi Tuckerm. (*C. abbreviata* Prescott) Occasional on dry, open banks. Sask.: 4237.

C. viridula Michx. (*C. oederi* Retz var. *viridula* (Michx.) Kük.) Occasional in bogs. Sask.: 5113. Alta.: R. G. H. Cormack 158 (DAO).

C. xerantica Bailey Occasional on the open plateau. Sask.: 4992.

Eleocharis acicularis (L.) Roem. & Schult. In dried-up pond. Sask.: 5137.

E. calva Torr. Common on gravel bars along streams. Sask.: 5155. Alta.: R. G. H. Cormack 329 (DAO).

E. palustris Roem. & Schult. Common in marshes. Sask.: 4950. Alta.: 5275.

Eriophorum angustifolium Honck. Alta.: Cypress Hills, R. G. H. Cormack 252 (DAO).

Scirpus acutus Muhl. (*S. occidentalis* (S. Wats.) Chase) Abundant in Twin Lakes, Alta.: 5283. Elkwater Lake, R. G. H. Cormack 446 (DAO).

S. americanus Pers. Along a creek. Sask.: East-end, 5439.

S. microcarpus Presl (*S. rubrotinctus* Fern.) Scarce; in marshland. Sask.: Cypress Hills Park, 4522. Alta.: Elkwater Lake, 13720.

S. nevadensis S. Wats. Sask.: Cypress Hills, Macoun 16415 (Can).

S. pauciflorus Lightf. (*Eleocharis pauciflora* (Lightf.) Link) Common in marsh. Sask.: Fort Walsh, 5201.

S. validus Vahl Common along the margins of lakes. Sask.: 4632.

LEMNACEAE

Lemna minor L. Floating on stagnant pools. Sask.: 4262. Alta.: 5285.

L. trisulca L. Common in water. Alta.: Twin Lakes, 5280.

JUNCACEAE

Juncus alpinus Vill. (*J. richardsonianus* Schult.) Occasional in moist meadows. Sask.: 5200.

J. balticus Willd. (*J. ater* Rydb.) Occasional in moist meadows. Sask.: 4350. Alta.: R. G. H. Cormack 122 (DAO).

J. bufonius L. Occasional in damp places. Sask.: 5022.

J. confusus Cov. Occasional in depressions on the plateau. Sask.: 4313. Alta.: 5644.

J. dudleyi Wieg. Occasional in wet meadows. Sask.: 4587. Alta.: R. G. H. Cormack 428 (DAO).

J. ensifolius Wikstr. Scarce; in springy places. Sask.: 4474.

J. longistylis Torr. Scarce; in damp meadows. Sask.: 4542.

J. nodosus L. Common in wet meadows. Sask.: 4582. Alta.: R. G. H. Cormack 419 (DAO).

J. saximontanus A. Nels. (*J. ensifolius* Wikstr. var. *major* Hook.; *J. mertensianus* sensu Fraser and Russell) Occasional in wet meadows. Sask.: 4852. Alta.: 5654.

Luzula multiflora (Ehrh.) Lej. (*L. campestris* (L.) DC. var. *multiflora* (Retz.) Celak.; *Juncooides intermedium* (Thuill.) Rydb.) Occasional on wooded banks. Sask.: 4225. Alta.: 5640.

LILIACEAE

Allium cernuum Roth (*A. recurvatum* Rydb.) Frequent on dry hillsides. Sask.: 4836.

A. stellatum Ker. Prairies and open plains. Sask.: Cypress Hills, Macoun 27430 (Can).

A. textile Nels. & Macbr. Occasional on dry hills. Sask.: 4825.

Disporum trachycarpum S. Wats. Common in aspen woods. Sask.: 5336.

Smilacina amplexicaulis Nutt. (*S. racemosa* (L.) Desf. var. *amplexicaulis* (Nutt.) S. Wats.; *S. racemosa* sensu Fraser and Russell) Frequent in aspen woods. Sask.: 4377. Alta.: 5540.

S. stellata (L.) Desf. Common in aspen woods. Sask.: 4185. Alta.: 13753.

Smilax herbacea L. var. *lasioneura* (Hook.) A. DC. (*Nemexia lasioneuron* (Hook.) Rydb.) Scarce; on dry banks. Sask.: 5473.

Streptopus amplexifolius L. Rare; in damp shaded places. Sask.: 4200. Alta.: 5682.

Zygadenus elegans Pursh (*Anticlea elegans* (Pursh) Rydb.; *Stenanthium occidentale* sensu A. C. Budd (3), not A. Gray) Frequent in grassland on the plateau. Sask.: 4425. Alta.: 5643.

Z. gramineus Rydb. (*Toxicoscordion gramineum* Rydb.; *Z. intermedius* Rydb.) Common in moist depressions on the plateau. Sask.: S. E. Clarke, June 25, 1940 (DASC).

IRIDACEAE

Sisyrinchium angustifolium Mill. (*S. montanum* Greene; *S. septentrionale* Bickn.) Occasional on the plateau. Sask.: 4491. Alta.: 5641.

ORCHIDACEAE

Calypso bulbosa (L.) Oakes (*C. borealis* (L.) Salisb.; *Cytheria bulbosa* (L.) House) Rare; in pine woods. Alta.: 5641.

Corallorhiza maculata Raf. Occasional in aspen woods. Sask.: 4204.

C. striata Lindl. Occasional in aspen woods. Sask.: 4221. Alta.: 5612. A yellow form, *C. ochroleuca* Rydb., was collected at Elkwater Lake by R. G. H. Cormack. See Canadian Field-Naturalist 62: 156, 1948.

C. trifida Chatelain Occasional in dry pine woods. Sask.: 4183.

Cypripedium passerinum Richards. Scarce; along streams in spruce forest. Sask.: 5069. Alta.: 5618.

Goodyera oblongifolia Raf. (*G. decipiens* (Hook.) Hubbard; *G. menziesii* Lindl.; *Paranium decipiens* (Hook.) Piper) Common in pine woods. Sask.: 4483.

Habenaria dilatata (Pursh) Hook. (*Limnorchis dilatata* (Pursh) Rydb.) Thickets by spring. Sask.: Cypress Hills, Macoun 4403 (Can).

H. hyperborea Coult. (*Limnorchis viridiflora* (Cham.) Rydb.) Common in swamps. Sask.: 4246. Alta.: 5631.

H. obtusata (Pursh) Richards. (*Lysiella obtusata* (Pursh) Rydb.) Occasional in spruce forest. Sask.: 4245. Alta.: 5558.

H. viridis (L.) R. Br. var. *bracteata* (Willd.) A. Gray (*Coeloglossum bracteatum* (Willd.) Parl.) Occasional around aspen bluffs. Sask.: 4394. Alta.: 5084.

Listera borealis Morong (*L. convallarioides* sensu Fraser and Russell). Scarce; in spruce forest. Sask.: 4713. Alta.: 13754.

L. cordata (L.) R. Br. Reported from the Cypress Hills by Fraser and Russell (11) and by Cormack (5).

Orchis rotundifolia L. Common in springy places in spruce forest. Sask.: 4712. Alta.: 5619. The variety *lineata* Mousley, Canadian Field-Naturalist 55: 65, 1941, is a rare form found at Elkwater Lake by W. C. McCalla, and again by R. G. H. Cormack (5).

Spiranthes romanzoffiana Cham. (*S. stricta* Rydb.) Rare; in wet meadows. Sask.: 4947. Alta.: 5515.

SALICACEAE

Populus angustifolia James Along Frenchman River. Sask.: Cypress Hills, Macoun, 16256 (Can).

P. balsamifera L. (*P. tacamahacca* Mill.; *P. candicans* Michx.; *P. acuminata* of Macoun's Cat. (23) as to report from Cypress Hills) Common in wet places. Sask.: 4374. Alta.: 5519.

P. tremuloides Michx. Abundant in valleys and on the north slopes. Sask.: 4621. Alta.: 5649.

Salix amygdaloides Anderss. Scarce; along lakes and streams. Sask.: 4227. Alta.: 5507.

S. bebbiana Sarg. (*S. rostrata* Richards.; *S. perrostrata* Rydb.) Common in valleys and around aspen bluffs. Sask.: 4223.

S. brachycarpa Nutt. (*S. desertorum* sensu Macoun Cat. Can. Plants) Sask.: Cypress Hills, *J. M. Macoun* 24465 (Can.).

S. candida Flügge Occasional in marshes. Sask.: 4758. Alta.: 5264.

S. caudata (Nutt.) Heller (*S. fendleriana* Anderss.) Along Battle Creek, Fort Walsh, Sask.: 4757.

S. discolor Muhl. Occasional in wet places. Sask.: 4599. Alta.: 5523.

S. drummondiana Barratt Common along creek. Alta.: Spring Creek Ranger Station, *R. G. H. Cormack* 7 (UnA). See Amer. Midl. Nat. 45: 742, 1951.

S. interior Rowlee (*S. longifolia* Muhl.) Occasional along streams. Sask.: 4226.

S. lutea Nutt. Common along streams. Sask.: 4255.

S. maccalliana Rowlee Occasional in swampy places. Sask.: 5123. Alta.: 5633.

S. myrtillifolia Anderss. (*S. pseudomyrsinites* Anderss.) Shrub 2 to 3 feet high. Swampy place in Mitchell Coulee on north-facing escarpment above Elkwater Lake, Alta.: 13752. Reported from the Saskatchewan side of the Cypress Hills by Fraser and Russell (11).

S. planifolia Pursh (*S. chlorophylla* Anderss.; *S. nelsonii* Ball) Common in marshlands and bogs. Sask.: 4520.

S. pseudocordata (Anderss.) Rydb. (*S. curtiflora* Anderss.; *S. monochroma* Ball) Shrub 6 to 10 feet high. Common along streams west of The Gap. Sask.: 4756. Alta.: 5100.

S. pseudomonticola Ball Common in swampy places. Sask.: 4203. Alta.: 5508.

S. scouleriana Barratt (*S. flavescens* Nutt.) Common in pine and aspen woods. Sask.: 4202. Alta.: 5572.

S. serissima (Bailey) Fern. Occasional in swamps and bogs. Sask.: 4178. Alta.: 5099.

BETULACEAE

Betula fontinalis Sarg. (*B. microphylla* Bunge var. *fontinalis* (Sarg.) M. E. Jones; *B. occidentalis* S. Wats., not Hook.) Common along streams. Sask.: 4368. Alta.: 5075.

B. papyrifera Marsh. var. *subcordata* (Rydb.) Sarg. (*B. subcordata* Rydb.) Common in the East Block at Birch Creek Ranger Station, Sask.: 4823. A few trees were also located in Battle Creek Valley near Fort Walsh, 5247.

B. pumila L. var. *glandulifera* Regel (*B. glandulifera* (Regel) Butler) Occasional in

swamps and bogs. Sask.: 5122. Alta.: 5268.

Corylus cornuta Marsh. (*C. rostrata* Ait.; *C. americana* of Macoun (23) as to report from Cypress Hills). Wooded ravine. Sask.: East-end, 5479. This species is apparently highly localized in the Cypress Hills and local residents state that Eastend is the only locality in the area where it occurs. Macoun collected this shrub in 1880 "in thickets, Cypress Hills, N.W.T.", probably at the same locality.

URTICACEAE

Parietaria pensylvanica Muhl. Cypress Hills, Sask.: *Macoun* 23981 (Can.).

Urtica gracilis Ait. (*U. lyallii* of eastern Am. auth., not S. Wats.) Occasional in damp places. Sask.: 4539.

LORANTHACEAE

Arceuthobium americanum Nutt. (*Razoumofskyia americana* (Nutt.) Kuntze) Parasitic on lodgepole pine. Alta.: 5586.

SANTALACEAE

Comandra pallida A. DC. Scarce; in grassland on the plateau. Sask.: 4377.

POLYGONACEAE

Eriogonum flavum Nutt. Common on dry exposed hillsides. Sask.: 4641. Alta.: 5095.

Polygonum achoreum Blake Occasional along roadsides. Sask.: 4603.

P. aviculare L. (*P. heterophyllum* Lindm. f.; *P. rubescens*, *P. buxiforme* Small) Introduced weed; occasional along roadsides and around dwellings. Sask.: 5401. Alta.: 3592.

P. bistortoides Pursh (*Bistorta bistortoides* (Pursh) Small). Occasional around aspen groves at Spring Creek Ranger Station, Alta.: 14198.

P. coccineum Muhl. (*Persicaria coccinea* (Muhl.) Greene) Occasional in marshlands. Sask.: 4569.

P. coccineum Muhl. var. *pratincta* (Greene) Stanford (*Persicaria pratincta* Greene) Scarce; in wet meadows. Sask.: 4676. Alta.: 5592.

P. confertiflorum Nutt. (*P. watsonii* Small, as to description) Dry gravelly prairie. Sask.: Cypress Hills, *Macoun* 23577 (Can.).

P. convolvulus L. (*Bilderdykia convolvulus* (L.) Dum.) Occasional in waste places; introduced. Sask.: 4625.

P. douglasii Greene Occasional on dry hillsides; grassland. Sask.: 4325. Alta.: 5580.

P. lapathifolium L. (*Persicaria lapathifolia* (L.) S. F. Gray; *P. tomentosa* (Schrank)

Bickn.) Occasional along streams. Sask.: 5185.

P. natans A. Eat. (*Persicaria fluitans* (A. Eat.) Greene; *P. nebrascensis* Greene) Common in shallow water. Sask.: 4560. Alta.: 5264.

Rumex acetosella L. Roadside through pine woods; introduced. Sask.: 4651.

R. mexicanus Meissn. (*R. triangulivalvis* (Danser.) Rech. f.) See Raup in Sargentia 6: 165, 1947. Frequent in moist meadows. Sask.: 4535.

R. occidentalis S. Wats. (*R. fenestratus* Greene) Frequent in wet meadows. Sask.: 4945.

CHENOPODIACEAE

Atriplex hastata L. (*A. patula* L. var. *hastata* (L.) A. Gray) Borders of saline marshes and lakes. Sask.: Cypress Hills, *Macoun* 23278 (Can).

A. nuttallii S. Wats. Occasional on dry hills. Sask.: 5367.

Axyris amaranthoides L. Introduced weed along roadsides and waste places. Sask.: 5372.

Chenopodium album L. Introduced weed in waste places. Sask.: 5371.

C. glaucum L. (*C. salinum* Standley) Occasional in saline meadows. Sask.: 5134.

C. hybridum L. (*C. gigantospermum* Aellen) Moist places. Sask.: Cypress Hills, *Macoun* 23330 (Can).

C. leptophyllum Nutt. Scarce; on dry banks. Sask.: 4788.

Eurotia lanata (Pursh) Moq. Occasional on dry hills. Sask.: 5461.

Monolepis nuttalliana (Schult.) Greene Roadside weed; introduced. Sask.: 4920.

Salsola kali L. var. *tenuifolia* Tausch *S. pestifer* A. Nels.) Found but once, along roadside in The Gap; introduced. Sask.: 5370.

Sarcobatus vermiculatus (Hook.) Torr. Saline soil. Sask.: Cypress Hills, W. *Shevkenek* (DAO).

AMARANTHACEAE

Amaranthus graecizans L. (*A. blitoides* S. Wats.) Roadside weed; introduced. Sask.: 5133.

A. retroflexus L. Roadside weed; introduced. Sask.: 5699.

NYCTAGINACEAE

Allionia hirsuta Pursh (*A. pilosa* (Nutt.) Rydb.; *A. linearis* of *Macoun* (23) as to report

from Cypress Hills; *Mirabilis*; *Oxybaphus*) Scarce; on dry eroded banks. Sask.: 5496.

PORTULACACEAE

Claytonia lanceolata Pursh Moist woods. Sask.: J. L. Bolton, May 28, 1936 (DASC; UnS).

C. linearis Dougl. (*Moniastrum lineare* (A. Gray) Rydb.; *Montia linearis* (Dougl.) Greene) Sask.: R. C. Russell, June 25, 1936 (DAO; DASC; UnS).

CARYOPHYLLACEAE

Arenaria congesta Nutt. (*A. lithophila* Rydb.) Common on dry exposed hillsides; grassland. Sask.: 4326. Alta.: 5530.

A. lateriflora L. (*Moehringia lateriflora* (L.) Fenzl.) Common in aspen woods. Sask.: 4349.

A. rubella (Wahlenb.) Sm. (*A. propinqua* Richards.; *Alsinopsis propinqua* (Richards.) Rydb.) Scarce; on dry exposed hills. Sask.: 4384. Alta.: 5083.

Cerastium arvense L. (*C. campestre* Greene) Frequent on dry hills. Sask.: 4785.

Paronychia sessiliflora Nutt. Common on dry hills; grassland. Sask.: 4751.

Silene cserei Baumg. Introduced weed on dry gravelly cut-bank at entrance to Cypress Hills Provincial Park, Sask.: 4708.

S. drummondii Hook. (*Lychnis drummondii* (Hook.) S. Wats.; *Wahlbergella drummondii* (Hook.) Rydb.) Occasional on dry hills. Sask.: 4417.

S. menziesii Hook. Rare; on dry slope. Sask.: Fort Walsh, 5225.

Stellaria borealis Bigel. (*S. calycantha* (Ledeb.) Bong.; *Alsine borealis* (Bigel.) Britton) Scarce; in damp shaded places. Sask.: 5143.

S. crassifolia Ehrh. (*Alsine crassifolia* (Ehrh.) Britton) Scarce; in damp shaded places. Sask.: *Macoun* 4792 (Can).

S. longifolia Muhl. (*Alsine longifolia* (Muhl.) Britton) Occasional in damp shaded places. Sask.: 4348.

S. longipes Goldie (*Alsine longipes* (Goldie) Coville; *A. strictiflora* Rydb.) Gravelly soil. Sask.: *Macoun* 4788 (Can).

RANUNCULACEAE

Actaea rubra (Ait.) Willd. Occasional in aspen woods. Sask.: 4620. The white-fruited form, *neglecta* (Gillman) Robins. (*R. eburnea* Rydb.) occurs associated with the species.

A. rubra (Ait.) Willd. ssp. **arguta** (Nutt.) Hult. (*A. arguta* Nutt.) Rich woods. Alta.: Mitchell Coulee, Elkwater Lake, 13750. White-fruited forms also occur.

Anemone canadensis L. Common in aspen woods. Sask.: 4235.

A. cylindrica A. Gray. Occasional in parkland. Sask.: 4724.

A. multifida Poir. var. **globosa** (Nutt.) Torr. & Gray (*A. globosa* Nutt.) Frequent in grassland on the plateau. Sask.: 4259. Flowers usually red, but cream-coloured forms also occur.

Clematis ligusticifolia Nutt. In valley of Frenchman River, Eastend, Sask.: 5469.

C. verticillaris DC. var. **columbiana** (Nutt.) A. Gray (*Atragene columbiana* Nutt.) Frequent in pine and aspen woods. Sask.: 4199. Alta.: 5546.

Delphinium bicolor Nutt. (*D. virescens* and *D. menziesii* of Macoun (23) reported from the Cypress Hills) Common on the plateau in grassland. Sask.: 4404.

Myosurus aristulatus Benth. Wet places. Sask.: J. L. Bolton, June 26, 1936 (DAO; UnS).

M. lepturus (A. Gray) Howell Reported from the Cypress Hills by Fraser and Russell (11).

M. minimus L. Reported from the Cypress Hills by Fraser and Russell (11).

Pulsatilla ludoviciana (Nutt.) Heller (*Anemone patens* L. var. *wolfgangiana* (Bess.) Koch) Common on dry prairie. Sask.: 4329.

Ranunculus acris L., *R. stevenii* Andrzej. Sask.: Cypress Hills, S. E. Clarke (DAO). Alta.: roadside near summit of plateau, south of Elkwater Lake, 14186.

R. abortivus L. Scarce; in springy places. Sask.: 4358.

R. aquatilis L. var. **capillaceus** (Thuill.) DC. (*Batrachium trichophyllum* (Chaix) F. Schultz) Sask.: in brook by power house, Cypress Hills Park, 14212.

R. aquatilis L. var. **divaricatus** (Schränk) A. Gray (*R. subrigidus* W. Drew; *Batrachium divaricatum* (Schränk) Wimmer) Common in ponds. Sask.: 4741.

R. aquatilis L. var. **longirostris** (Godr.) Lawson (*Batrachium longirostre* (Godr.) F. Schultz) In streams. Sask.: Battle Creek at Fort Walsh, 5194.

R. cardiophyllus Hook. (*R. pedatifidus* J. E. Sm. var. *cardiophyllus* (Hook.) Britton) Common on the plateau in grassland. Sask.: 4210.

R. cymbalaria Pursh (*Halerpestes cymbalaria* (Pursh) Greene) Scarce; in damp places. Sask.: 4271.

R. glaberrimus Hook. (*R. ellipticus* Greene; *R. buddii* Boivin) Low areas on benchlands. Sask.: Consul, A. C. Budd, April 29, 1947 (DAO; DASC).

R. inamoenus Greene Occasional near the heads of ravines. Sask.: 4406. Alta.: 5080.

R. macounii Britton Frequent in damp meadows. Sask.: 4236.

R. pedatifidus J. E. Sm. (*R. affinis* R. Br.) In fescue grassland. Alta.: Spring Creek Ranger Station, 13760.

R. purshii Richards. (*R. gmelinii* DC. var. *hookeri* (D. Don.) Benson) Occasional in ponds. Sask.: 4646.

R. reptans L. (*R. flamula* L. var. *reptans* (L.) E. Meyer) Rare; in dried-up pond. Sask.: 5136.

R. rhomboideus Goldie (*R. ovalis* auth., not Raf.) Common on open prairie. Sask.: 4440.

R. sceleratus L. Occasional in wet places. Sask.: 4261.

Thalictrum dasycarpum Fisch. & Lall. Thickets. Sask.: Macoun 2955 (Can). This species was also observed by the writer in aspen woods at Elkwater Lake, Alta.

T. occidentale A. Gray (*T. megacarpum* Torr.) Occasional on moist wooded banks. Sask.: 4222. Alta.: 5567.

T. venulosum Trel. (*T. dioicum* of western reports, not L.; *T. columbianum* Rydb.; *T. lunellii* Greene; *T. turneri* Boivin) Occasional in aspen groves and grassland. Sask.: 4213. Dr. G. H. Turner agrees with the writer that *T. turneri* is a lush woodland phase (ecotype) of *T. venulosum*. He states: "*Thalictrum venulosum* and *T. turneri* are not distinct and grade into one another from the tiniest dwarf of the open prairie up to the 5-foot giant of poplar woods. When cultivated, *T. venulosum* will grow as tall as *T. turneri*".

FUMARIACEAE

Corydalis aurea Willd. (*Capnoides aureum* (Willd.) Kuntze) Scarce; in woods. Sask.: 4528.

CRUCIFERAE

Arabis divaricarpa A. Nels. (*A. brachycarpa* (Torr. & Gray) Britton) Occasional on dry hillsides; prairie. Sask.: 4322.

A. drummondii A. Gray (*A. lyallii* of Macoun (23) report from Cypress Hills) Dry hills. Sask.: W. Shevkenek, July 1938 (DAO). Alta.: H. Groh, June 9, 1931 (DAO).

A. glabra (L.) Bernh. (*Turritis glabra* L.) Scarce; on dry hillsides. Sask.: reported from the Cypress Hills by Fraser and Russell (11). Alta.: 13722.

A. hirsuta (L.) Scop. (*A. ovata* (Pursh) Poir.) Occasional on the plateau in grassland. Sask.: 4455.

A. holboellii Hornem. var. *retrofracta* (Grah.) Rydb. *A. retrofracta* Grah.) On dry exposed hillside. Sask.: Eastend, 5457.

A. hookeri Lange (*Arabidopsis virgata* (Nutt.) Rydb.; *A. stenocarpa* Rydb.) Sask.: Sucker Creek, Cypress Hills, Macoun 10006 (Can). See Porsild in Sargentia 4: 43, 1943.

Barbarea orthoceras Ledeb. (*B. americana* Rydb.) Scarce; along springs. Sask.: 4244.

Cardamine pensylvanica Muhl. (*Nasturtium officinale* sensu Fraser and Russell pro parte). Uncommon; in wet meadows. Sask.: 4254.

Descurainia pinnata (Walt.) Britton ssp. *brachycarpa* (Richards.) Detling (*Sophia brachycarpa* (Richards.) Rydb.) Scarce; on dry eroded banks. Sask.: 5151.

D. sophia (L.) Webb. (*Sophia multifida* Gilib.) Common roadside weed; introduced. Sask.: 4608.

Draba nemorosa L. Common on dry hillsides. Sask.: 4343.

Erysimum cheiranthoides L. (*Cheirinia cheiranthoides* (L.) Link) Frequent in moist woods. Sask.: 4763.

E. parviflorum Nutt. (*Cheirinia inconspicua* (S. Wats.) Rydb.) Scarce; on the open plateau in grassland. Sask.: 4433.

Lepidium densiflorum Schrad. (*L. apetalum* A. Gray) Roadside weed; introduced. Sask.: 5001.

Lesquerella alpina Torr. & Gray (*L. spathulata* Rydb.) Dry eroded hillsides. Sask.: 5451.

L. ludoviciana (Nutt.) S. Wats. (*L. arenosa* (Richards.) Rydb.; *L. rosea*, *L. versicolor* Greene) Dry eroded hillsides. Sask.: 5221.

Rorippa palustris (L.) Besser (*R. islandica* (Oeder) Borbas var. *microcarpa* (Regel) Fern.; *Nasturtium officinale* sensu Fraser and Russell pro parte) Occasional in wet places. Sask.: 4677.

Sisimbrium altissimum L. Roadside weed; introduced. Sask.: 4624.

Thlaspi arvense L. Common roadside weed; introduced. Sask.: 4536.

CAPPARIDACEAE

Cleome serrulata Pursh (*Peritoma serrulatum* (Pursh) DC.) Occasional along roadsides at lower elevations. Sask.: The Gap 5059.

CRASSULACEAE

Sedum stenocarpum Pursh (*S. lanceolatum* Torr.; *S. douglasii* sensu Macoun Cat. Can. Plants (23) as to reports from Cypress Hills) Common on dry exposed hills. Sask.: 4559. Alta.: 5093.

SAXIFRAGACEAE

Heuchera flabellifolia Rydb. Exposed hill-sides in grassland; rare. Alta.: R. G. H. Cormack 391 (UnA).

H. richardsonii R. Br. (*H. hispida* of western Amer. auth., not Pursh) Occasional in grassland on the plateau. Sask.: 4398. Alta.: 14190.

Mitella nuda L. Occasional in moist spruce woods. Sask.: 4247.

Parnassia palustris L. Occasional on river bars and other wet places. Sask.: 4963.

Ribes aureum Pursh (*Chrysobotrya aurea* (Pursh) Rydb.) Occasional along Frenchman River. Sask.: Eastend, 5483. Alta.: R. G. H. Cormack 63 (UnA).

R. hudsonianum Richards. Occasional in damp woods. Sask.: 4243.

R. lacustre (Pers.) Poir. (*Limnobotrya lacustris* (Pers.) Rydb.) Scarce; in spruce woods. Sask.: 4680. Alta.: 5621.

R. oxyacanthoides L. (*Grossularia oxyacanthoides* (L.) Mill.) Common in aspen woods. Sask.: 4502.

R. triste Pall. Occasional in pine woods. Sask.: 4233.

Saxifraga rhomboidea Greene (*Micranthes rhomboidea* (Greene) Small) Rare; on dry hills in grassland. Sask.: 4212.

ROSACEAE

Amelanchier alnifolia Nutt. (*A. carrii* Rydb.; *A. humilis* of western Am. auth., not Wieg.) See Jones in Illinois Biological Monographs, 20: 67-73, 1946. Common in aspen woods and open hillsides. Sask.: 4396.

Chamaerhodos nuttallii (Torr. & Gray) Pickering (*C. erecta* (L.) Bunge ssp. *nuttallii* (Torr. & Gray) Hult.) Occasional on dry hills. Sask.: 5057.

Crataegus chrysocarpa Ashe Occasional on hillsides. Sask.: 4857.

C. columbiana Howell (*C. succulenta* sensu Fraser and Russell) Common in valleys. Sask.: 4776. Alta.: 5507.

C. douglasii Lindl. (*C. brevispina* (Dougl.) Farwell) Common in valleys. Sask.: 4733.

Fragaria glauca (S. Wats.) Rydb. (*F. pauciflora* Rydb.) Common in aspen woods and prairie. Sask.: 4341.

Geum allepicum Jacq. var. **strictum** (Ait.) Fern. (*G. strictum* Ait.) Occasional in open woods. Sask.: 4540.

G. macrophyllum Willd. var. **perincisum** (Rydb.) Raup (*G. perincisum* Rydb.; *G. oregonense* Rydb., not Scheutz) Common in wet meadows. Sask.: 4248.

G. rivale L. Abundant in marshes. Sask.: 4496. Alta.: 5517.

G. triflorum Pursh var. **ciliatum** (Pursh) Fassett (*Sieversia ciliata* (Pursh) G. Don) Common in grassland on the plateau. Sask.: 4463.

Potentilla anserina L. (*Argentina anserina* (L.) Rydb.; *A. argentea* Rydb.) Occasional in wet meadows and river bars. Sask.: 4673.

P. arguta Pursh (*Drymocallis agrimonoides* (Pursh) Rydb.) Frequent on dry hillsides; prairie. Sask.: 4558.

P. bipinnatifida Dougl. (*G. pensylvanica* L. var. *bipinnatifida* (Dougl.) Torr. & Gray) Occasional in grassland. Sask.: 4438. Alta.: 5604.

P. concinna Richards. (*P. divisa* Rydb.) Occasional on dry exposed hills. Sask.: 4453. Alta.: 5536.

P. diversifolia Lehm. (*P. glaucophylla* Lehm.; *P. juncunda* sensu Fraser and Russell) Occasional in grassland on the plateau. Sask.: 4430. Alta.: 5292.

P. effusa Dougl. (*P. argyrea* Rydb.) Occasional on dry hills. Sask.: 5361.

P. fruticosa L. (*Dasiphora fruticosa* (L.) Rydb.) Abundant in the fescue grassland on the plateau. Sask.: 4679. Alta.: 5610.

P. gracilis Dougl. (*P. nuttallii* Lehm.; *P. rigida* Nutt.; *P. camporum*, *P. filipes*, *P. viridescens* Rydb.) Common in grassland on the plateau. Sask.: 4447.

P. hippiana Lehm. (*P. propinqua* Rydb.) Common on dry slopes; prairie. Sask.: 4819.

P. norvegica L. (*P. monspeliensis* L.; *P. hirsuta* Michx.) Occasional in moist meadows. Sask.: 4495.

P. palustris (L.) Scop. (*Comarum palustre* L.) Occasional in swampy places. Sask.: 4475.

P. pensylvanica L. *P. strigosa* Pursh, not Pall.; *P. lasiodonta*, *P. glabrella*, *P. platyloba* Rydb.) Common on dry hills. Sask.: 4437.

P. plattensis Nutt. Moist meadow. Sask.: Eastend, Macoun 10483 (Can.).

P. pulcherrima Lehm. (*P. gracilis* Dougl. var. *pulcherrima* (Lehm.) Fern.) Common in grassland on the plateau. Sask.: 4448. Alta.: 5645.

Prunus pensylvanica L.f. Occasional on dry hillsides. Sask.: 4545.

P. virginiana L. var. **melanocarpa** A. Nels. (*P. melanocarpa* (A. Nels.) Rydb.) Frequent on wooded banks. Sask.: 4201.

Rosa acicularis Lindl. (*R. bourgeauiana* Crep.) Common in aspen woods. Sask.: 4403. Alta.: 5538.

R. arkansana Porter var. **suffulta** (Greene) Cockerell (*R. alcea*, *R. pratincola* Greene) Common on dry hills; prairie. Sask.: 4616.

R. woodsii Lindl. (*R. macounii* Greene). Common in aspen woods. Sask.: 4546. Alta.: 5537. Stems armed with straight round prickles.

R. woodsii Lindl. var. **TERRENS** (Lunell) stat. nov. (*R. terreus* Lunell, Amer. Midl. Nat. 2: 155, 1912) Frequent on dry banks. Sask.: 5168. Armed with numerous, stout, more or less flattened prickles; flowers solitary or few.

Rubus acaulis Michx. Rare; in spruce swamp. Sask.: 5108.

R. paracaulis Bailey (*R. acaulis* x *pubescens*) Occasional in swampy places.

R. parviflorus Nutt. (*Rubacer parviflorum* (Nutt.) Rydb.) Rare; one colony found in the valley of Grayburn Creek, about one mile west of the Sask.-Alta. border: 5670.

R. pubescens Raf. Frequent in spruce and aspen woods. Sask.: 4191.

R. strigosus Michx. (*R. subarcticus* (Greene) Rydb.) Occasional in aspen woods. Sask.: 4596.

Sorbus scopulina Greene Occasional on wooded banks. Sask.: 4817.

Spiraea lucida Dougl. Common in pine woods. Sask.: 4529.

LEGUMINOSAE

Astragalus aboriginum Richards. (*Atelophragma aboriginum* (Richards.) Rydb.) Sask.: Cypress Hills, Macoun 4239 (Can.).

- A. agrestis** Dougl. (*A. goniatus* Nutt.; *A. hypoglottis* Richards., not L.) Frequent in grassland on the plateau. Sask.: 4462.
- A. americanus** (Hook.) M. E. Jones (*Phaca americana* (Hook.) Rydb.) Occasional in aspen woods. Sask.: 4783. Alta.: 5563.
- A. bisulcatus** (Hook.) A. Gray (*Diholcus bisulcatus* (Hook.) Rydb.) Occasional on dry prairie. Sask.: 5406.
- A. caespitosus** (Nutt.) A. Gray (*Homalobus caespitosus* Nutt.) Common on the rim of the plateau; exposed situations. Sask.: 5365. Alta.: 5257.
- A. canadensis** L. Occasional around aspen woods. Sask.: 4556. Alta.: 5539.
- A. drummondii** Dougl. (*Tium drummondii* (Dougl.) Rydb.) Occasional on dry grassy slopes. Sask.: 4839.
- A. lotiflorus** Hook. (*Batidophaca lotiflora* (Hook.) Rydb.) On clay flats. Sask.: Cypress Hills, Macoun 4286 (Can.).
- A. missouriensis** Nutt. (*Xylophacos missouriensis* (Nutt.) Rydb.) Dry slopes. Sask.: Cypress Hills, Macoun 4302. (Can.).
- A. pectinatus** Dougl. (*Cnemidophacos pectinatus* (Dougl.) Rydb.) Occasional in valleys. Sask.: 5352.
- A. striatus** Nutt. (*A. adsurgens* Hook., not Pall.) Frequent on dry exposed hillsides. Sask.: 4330.
- A. succulentus** Richards. (*Geoprimum succulentum* (Richards.) Rydb.) Scarce; on dry exposed slopes. Sask.: 4837. Alta.: 5096.
- A. tenellus** Pursh (*Homalobus tenellus* (Pursh) Britton). Occasional on dry banks. Sask.: 4838. Alta.: 13748.
- A. triphyllus** Pursh (*Orophaca caespitosa* (Nutt.) Britton). Frequent on dry exposed hills. Sask.: 4640.
- A. vexilliflexus** Sheld. (*A. pauciflorus* Hook., not Pall.; *Homalobus vexilliflexus* (Sheld.) Rydb.) Occasional on the rim of the plateau. Sask.: 5368.
- Glycyrrhiza lepidota** (Nutt.) Pursh Common in valleys. Sask.: 5414.
- Hedysarum alpinum** L. var. *americanum* Michx. (*H. americanum* (Michx.) Britton; *H. philoscia* A. Nels.) Common on the plateau. Sask.: 4413.
- H. boreale** Nutt. Occasional on dry steep west-facing slope. Alta.: Elkwater Lake 13726.
- H. boreale** Nutt. var. *cinerascens* (Rydb.) Rollins (*H. canescens* Nutt., not L.; *H. mackenzii* sensu Macoun (23) as to report from Cypress Hills) Dry eroded hills. Sask.: 5054.
- Lathyrus ochroleucus** Hook. Common in aspen woods. Sask.: 5331.
- Lupinus argenteus** Pursh (*L. macounii* Rydb.; *L. tenellus* Dougl.) Abundant in the fescue grassland on the plateau. Sask.: 4814. Alta.: 5607. Pink and white forms occur also, but rarely.
- Melilotus alba** Desv. Common along roadsides; introduced. Sask.: 4627.
- M. officinalis** (L.) Lam. Common along roadsides; introduced. Sask.: 4622.
- Oxytropis deflexa** (Pall.) DC. (*O. retrorsa* Fern.; *Aragallus deflexus* (Pall.) Heller) Scarce; in moist meadows in valleys. Sask.: 4408.
- O. gracilis** (A. Nels.) K. Schum. (*O. villosa* (Rydb.) K. Schum.; *Aragallus gracilis* A. Nels.) Occasional on dry slopes. Sask.: 4566. Alta.: 5527.
- O. spicata** (Hook.) Standley (*O. macounii* (Greene) Rydb.; *Aragallus spicatus* (Hook.) Rydb.) Frequent on dry hills. Sask.: 4408.
- Petalostemon candidus** (Willd.) Michx. Occasional on dry hills. Sask.: 5223.
- P. purpureus** (Vent.) Rydb. Occasional on dry slopes. Sask.: 5391. Forma *pubescens* (A. Gray) Fassett differs in having soft spreading pubescence on stem and leaves. Found at Fort Walsh, Sask.: 5390, where it was associated with the typical form.
- Psoralea argophylla** Pursh Occasional on dry hillsides. Sask.: 4710.
- P. esculenta** Pursh (*Pedimelon esculentum* (Pursh) Rydb.) Scarce; on dry hills. Sask.: 4815.
- Thermopsis rhombifolia** (Nutt.) Richards Frequent in grassland on the plateau. Sask.: 4220. Alta.: 13739.
- Trifolium hybridum** L. Introduced along roadside near top of the plateau south of Elkwater Lake, Alta.: 14182.
- T. pratense** L. Introduced along roadside south of Elkwater Lake, Alta.: 14184.
- T. repens** L. Introduced along roadside south of Elkwater Lake, Alta.: 14183.
- Vicia americana** Muhl. (*V. oregana*, *V. truncata* Nutt.) Frequent in aspen woods. Sask.: 5419.
- V. sparsifolia** Nutt. (*V. trifida* Dietr.; *V. americana* Muhl. var. *angustifolia* Nees) Scarce; in grassland on the plateau. Sask.: 5222.

GERANIACEAE

Geranium carolinianum L. (*G. sphaerospermum* Fern.) Frequent along roadsides through pine woods. Sask.: 4512.

G. bicknellii Britton Occasional along roadsides and burnt places. Sask.: 4470.

G. richardsonii Fisch. & Trautv. (*G. albiflorum* Hook.) Common in aspen woods. Sask.: 4207. Alta.: 5079.

G. viscosissimum Fisch. & Mey. (*G. strigosum*, *G. canum* Rydb.) Occurring only in the West Block, where it is common in valleys at an elevation of 3,900 to 4,200 feet. Sask.: Fort Walsh, 5755. Alta.: Elkwater Lake, 5078.

LINACEAE

Linum lewisii Pursh (*L. perenne* L. ssp. *lewisii* (Pursh) Hult.; *L. pratense* (Norton) Small) Frequent on dry hillsides. Sask.: 4642.

L. rigidum Pursh (*Cathartolinum rigidum* (Pursh) Small) Scarce; on dry hills. Sask.: 5013. Alta.: 5259.

BALSAMINACEAE

Impatiens biflora Walt. (*I. capensis* Meerb.) Springy places. Sask.: 8063.

EUPHORBIACEAE

Euphorbia glyptosperma Engelm. (*Chamaesyce glyptosperma* (Engelm.) Small) Roadside weed; introduced. Sask.: 5696.

E. serpyllifolia Pers. (*C. serpyllifolia* (Pers.) Small) Reported from the Cypress Hills by Fraser and Russell (11).

CALLITRICHACEAE

Callitriche autumnalis L. (*C. hermaphroditica* L.) Reported from the Cypress Hills by Fraser and Russell (11).

C. palustris L. (*C. verna* L.) Occasional in shallow water. Sask.: 4516.

ANACARDIACEAE

Rhus aromatica Ait. var. *trilobata* (Nutt.) Barkley (*R. canadensis* Marsh. var. *trilobata* (Nutt.) A. Gray; *R. trilobata* Nutt.) Scarce; on dry slopes. Sask.: Eastend, 5433.

R. radicans L. (*Toxicodendron radicans* (L.) Kuntze; *T. rydbergii* (Small) Greene) Occasional in thickets and open hillsides. Sask.: 4366.

ACERACEAE

Acer negundo L. (*Negundo interius* (Britton) Rydb.) Scarce; along streams. Sask.: Birch Creek Ranger Station, 4823.

MALVACEAE

Sphaeralcea coccinea (Nutt.) Rydb. (*Malvasium coccineum* (Pursh) A. Gray) Occasional on dry, exposed banks. This is the only salmon-coloured prairie flower. Sask.: 5213.

HYPERICACEAE

Hypericum majus (A. Gray) Britt. Low springy place. Cypress Hills, Macoun, 2751 (Can).

VIOLACEAE

Viola adunca Smith (*V. subvestita* Greene) Common on dry grassy slopes. Sask.: 4258.

V. nephrophylla Greene Occasional in wet meadows. Sask.: 4253.

V. nuttallii Pursh (*V. vallicola* A. Nels.; *V. russellii* Boivin) Dry soil; grassland. Sask.: Cypress Hills, Macoun, 2422 (Can).

V. renifolia A. Gray (*V. brainerdii* Greene) Occasional in moist woods. Sask.: 4346.

V. rugulosa Greene (*V. canadensis* of western Am. auth., not L.) Common in rich aspen woods. Sask.: 4376. Alta.: 5081.

LOASACEAE

Mentzelia decapetala (Pursh) Urban & Gilig. (*Nuttallia decapetala* (Pursh) Greene) Rare; on steep eroded bank. Sask.: Eastend, 5487.

CACTACEAE

Mamillaria vivipara (Nutt.) Haw. (*Neomamillaria vivipara* (Nutt.) Britton & Hose) Frequent on dry hills. Sask.: Eastend, 5499.

Opuntia polyacantha Haw. Common locally on dry hillsides in the larger river valleys. Sask.: Fort Walsh, 5348; Eastend, 5400.

ELAEAGNACEAE

Elaeagnus commutata Bernh. (*E. argentea* Pursh, not Moench) Common in river valleys. Sask.: 4808.

Shepherdia argentea Nutt. (*Lepargyrea argentea* (Nutt.) Greene) In valley of Frenchman River, Eastend, Sask.: 5468.

S. canadensis (L.) Nutt. (*Lepargyrea canadensis* (L.) Greene) Common in woods. Sask.: 4565.

ONAGRACEAE

Boisduvallia glabella (Nutt.) Walp. Rare; on moist depression. Sask.: 6635.

Epilobium angustifolium L. (*Chamaerion spicatum* (Lam.) S. F. Gray) Common in woodlands. Sask.: 4611.

E. glandulosum Lehm. (*E. adenocaulon* Haussk.) Frequent in springy places. Sask.: 4687.

E. leptophyllum Raf. (*E. lineare* of auth., not Muhl.) Occasional in swamps. Sask.: 4552.

E. oliganthum Michx. (*E. palustre* L. var. *oliganthum* (Michx.) Fern.) Springy place in spruce forest. Sask.: Battle Creek valley, 5117.

E. paniculatum Nutt. (*E. adenocladon* (Haussk.) Rydb.) Scarce; on dry exposed bank. Sask.: 4772.

Gaura coccinea (Nutt.) Pursh Occasional on dry hillsides. Sask.: 5393.

G. coccinea (Nutt.) Pursh var. **glabra** (Lehm.) Torr. & Gray (*G. glabra* Lehm.) On dry eroded bank. Sask.: 5152.

Oenothera biennis L. (*O. strigosa* (Rydb.) Mack. & Bush; *O. canescens* Torr. & Gray) Occasional along roadsides. Sask.: 4770.

O. caespitosa Nutt. (*Pachylophus caespitosus* (Nutt.) Raim.) Clay banks. Sask.: Farwell Creek, Macoun 10620. (Can).

O. flava (A. Nels.) Garratt (*Lavauxia flava* A. Nels.) Scarce; on dry banks. Sask.: 4988. Alta.: 5587.

O. nuttallii Sweet (*Anogra nuttallii* (Sweet) A. Nels.) Dry hillside; prairie. Sask.: 5215.

HALORAGIDACEAE

Hippurus vulgaris L. Frequent in shallow water. Sask.: 5418. Alta.: 5288.

Myriophyllum spicatum L. (*M. exalbescens* Fern.) Common in shallow water in Elkwater Lake, Alta.: 5504.

ARALIACEAE

Aralia nudicaulis L. Rare; on wooded north-facing slope. Alta.: Elkwater Lake, 5551.

UMBELLIFERAE

Cicuta douglasii (DC.) Coult. & Rose (*C. occidentalis* Greene) Occasional in marshes. Sask.: 4740.

Heracleum lanatum Michx. (*H. maximum* Bartr.) Common in rich moist meadows. Sask.: 4531.

Leptotaenia multifida Nutt. Rare; in a coulee near Battle Creek Ranger Station, Sask.: 5037.

Lomatium macrocarpum (Nutt.) Coult. & Rose (*Cogswellia macrocarpa* (Nutt.) M. E. Jones) Occasional on dry hillsides; prairie. Sask.: 4557. Alta.: 5088.

L. villosum Raf. (*L. foeniculaceum* Coult. & Rose; *Cogswellia villosa* (Raf.) Schultes) Dry hills. Sask.: Cypress Hills, Macoun 5002 (Can).

Musineon trachyspermum Nutt. (*M. divaricatum* (Pursh) Raf. var. *hookeri* (Nutt.) Mathias) Occasional on dry hills. Sask.: 5047.

Osmorhiza chilensis Hook. & Arn. (*O. divaricata* (Britt.) Saksd.; *O. intermedia* (Rydb.) Blankinship) Frequent on wooded banks. Sask.: 8102.

O. longistylis (Torr.) DC. Occasional in rich aspen woods. Sask.: 4850.

O. obtusa (Coult. & Rose) Fern. Frequent in rich aspen woods. Sask.: 4595.

Perideridia gairdneri (Hook & Arn.) Mathias (*Carum gairdneri* (Hook. & Arn.) A. Gray; *Atenia gairdneri* Hook & Arn.; *A. montana* (Blankinship) Rydb.) Common in meadows; submontane grassland. Sask.: 4767.

Sanicula marilandica L. Frequent in rich woods. Sask.: 4509.

Sium suave Walt. (*S. cicutaefolium* Gmel.) Scarce; in wet meadow. Sask.: 5141.

Zizia aptera (A. Gray) Fern. (*Z. cordata* (Walt.) Koch) Common in grassland on the plateau. Alta.: 5642.

CORNACEAE

Cornus canadensis L. (*Chamaerpericlimenium canadense* (L.) Ashe) Common in pine woods. Sask.: 4232.

C. stolonifera Michx. (*Svida stolonifera* (Michx.) Rydb.; *S. instolonea* A. Nels.; *S. interior* Rydb.) Occasional in valleys. Sask.: 4782.

PYROLACEAE

Chimaphila umbellata (L.) Bart. var. **occidentalis** (Rydb.) Blake (*C. occidentalis* Rydb.) Scarce; in pine woods. Sask.: 4508. Alta.: 5585.

Moneses uniflora (L.) A. Gray Common in moist woods. Sask.: 5303.

Monotropa lanuginosa Michx. (*Hypopithys lanuginosa* (Michx.) Nutt.; *H. latisquama* Rydb.) Scarce; in dry pine woods. Sask.: 5665.

Pterospora andromedea Nutt. Occasional in pine woods. Sask.: 4886. Alta.: 5613.

Pyrola asarifolia Michx. (*P. uliginosa* Torr.) Frequent in pine woods. Sask.: 4484.

P. elliptica Nutt. Scarce; in rich aspen woods. Sask.: 4867.

P. minor L. (*Braxilia minor* (L.) House) Occasional in damp coniferous woods. Sask.: 4347. Alta.: 5658.

P. secunda L. (*Orthilia secunda* (L.) House)
Frequent in coniferous woods. Sask.: 4959.
Alta.: 5656.

P. virens Schw. (*P. chlorantha* Sw.) Occasional
in pine woods. Sask.: 4504.

ERICACEAE

Arctostaphylos uva-ursi (L.) Spreng. Abundant
in dry pine forest. Sask.: 4657.

Vaccinium caespitosum Michx. Abundant in
dry pine woods. Sask.: 4339. Alta.: 5522.

PRIMULACEAE

Androsace septentrionalis L. var. *puberulenta*
(Rydb.) Knuth (*A. puberulenta* Rydb.; *A. septentrionalis* sensu Macoun (23) as to report from Cypress Hills) Occasional on dry exposed hills. Sask.: 4423.

Dodecatheon conjugens Greene (*D. cylindrocarpum* Rydb.) Frequent in fescue grassland on the plateau. Sask.: 4193, with mature capsules. Alta.: above Elkwater Lake, E. H. Moss, 9621, with mature capsules (Can).

D. pauciflorum (Durand) Greene (*D. salinum* A. Nels.) Moist prairie. Sask.: Cypress Hills, Macoun, 5318, with flowers and developed capsules (Can). Alta.: 14181, with mature capsules.

Glaux maritima L. Saline flat in The Gap. Sask.: 5373.

Lysimachia thyrsiflora L. (*Naumburgia thyrsiflora* (L.) Duby) Occasional in marshes. Sask.: 4537.

Primula incana M. E. Jones. Occasional along streams. Sask.: 5018.

Steironema ciliatum (L.) Raf. (*Lysimachia ciliata* L.) Occasional around aspen woods. Sask.: 4498.

GENTIANACEAE

Gentiana affinis Griseb. (*Dasystephana affinis* (Griseb.) Rydb.) Occasional along streams. Sask.: 5016. Alta.: 5603.

G. amarella L. (*G. acuta* Michx.; *G. plebeia* Cham.; *G. strictiflora* (Rydb.) A. Nels.; *G. scopulorum* Greene; *Amarella*) Occasional in open woods and grassland on the plateau. Sask.: 4747. Alta.: 5518.

APOCYNACEAE

Apocynum androsaemifolium L. (*A. scopulorum*, *A. ambigens* Greene) Frequent in open aspen woods. Sask.: 4855. Alta.: 13745.

A. sibiricum Jacq. (*A. cannabinum* L. var. *hypericifolium* (Ait.) A. Gray) Rare; on dry hillside. Sask.: Fort Walsh, 5394.

CONVOLVULACEAE

Convolvulus interior House (*C. macounii* Greene; *C. spithameus* sensu Macoun (23) in part) Thickets, Sask.: Cypress Hills, Macoun 5744 (Can).

Cuscuta magalocarpa Rydb. (*C. curta* (Engelm.) Rydb.) Cypress Hills, Sask.: Macoun, 17207 (Can). Parasitic on *Lygodesmia juncea*.

POLEMONIACEAE

Collomia linearis Nutt. (*Gilia linearis* (Nutt.) A. Gray) Common on dry slopes, Sask.: 4474.

Linanthus harknessii (Curran) Greene (*Gilia harknessii* Curran) Sask.: Cypress Hills, Macoun 11811 (CAN).

Navarretia minima Nutt. (*Gilia minima* A. Gray) Rare; in low depression. Sask.: 6636.

Phlox hoodii Richards. At top of ravine on dry grassy slope, Eastend, Sask.: A. E. Por-sild, 17928 (Can).

HYDROPHYLLACEAE

Ellisia nyctelea (L.) Britton Scarce; in aspen woods. Sask.: 4862.

Heliotropium spathulatum Rydb. Margins of saline ponds. Sask.: Cypress Lake, Macoun, 11851 (Can).

BORAGINACEAE

Allocarya californica (Fisch. & Mey.) Greene (*A. scopulorum* Greene) Scarce; in moist meadow. Sask.: 4675. Alta.: 5637.

Cryptantha crassise-pala (Torr. & Gray) Greene (*C. kelseyana* Greene) Rare; in dry soil. Sask.: 5236.

Lappula americana (A. Gray) Rydb. (*L. deflexa* (Wahl.) Garcke var. *americana* (A. Gray) Greene; *Hackelia americana* (A. Gray) Fern.) Occasional on moist wooded banks. Sask.: 4375. Alta.: 5077.

L. echinata Gilib. Introduced roadside weed. Sask.: 4916.

L. floribunda (Lehm.) Greene (*Hackelia floribunda* (Lehm.) Johnst.) Scarce; on wooded banks. Sask.: 8103.

Lithospermum rudera-le Lehm. Frequent on grassy slopes. Sask.: 5073. Alta.: 5256.

Oreocarya glomerata (Pursh) Greene (*O. macounii* Eastw.) Occasional on dry exposed hills in grassland. Sask.: 5047.

LABIATAE

Lycopus americanus Muhl. Occasional in wet meadows. Sask.: 4899.

L. asper Greene Occasional along streams. Sask.: 5482.

Mentha arvensis L. var. **glabrata** (Benth.) Fern. (*M. glabrior* (Hook.) Rydb.) Common in moist meadows. Sask.: 4793.

Moldavica parviflora (Nutt.) Britton (*Draccephalum parviflorum* Nutt.) Common roadside weed; introduced. Sask.: 4469.

Monarda fistulosa L. var. **menthaefolia** (Graham) Fern. (*M. menthaefolia* Graham) Common in valleys. Sask.: 4768.

Scutellaria epilobiifolia A. Hamilt. (*S. galericulata* Am. auth., not L.) Occasional in marshes. Sask.: 4517.

Stachys palustris L. ssp. **pilosa** (Nutt.) Epling (*S. scopulorum* Greene; *S. borealis* Rydb.) Frequent in damp meadows. Sask.: 4497.

SOLANACEAE

Solanum triflorum Nutt. Occasional on dry banks. Sask.: 5135.

SCROPHULARIACEAE

Besseyia cinerea (Raf.) Pennell (*Synthyris wyomingensis* (A. Nels.) Raf.) Scarce; on grassy slopes. Sask.: 5351. Alta.: 5089.

Castilleja miniata Dougl. (*C. rhexifolia* of Sask. reports, not Rydb.) Common in open meadows and pine woods. Sask.: 4760. Alta.: 5565.

C. sessiliflora Pursh Reported from the Cypress Hills by Fraser and Russell (11).

Collinsia parviflora Dougl. Common on dry semi-wooded hillsides. Sask.: 4180.

Mimulus guttatus DC. (*M. langsдорфii* Donn) Common in brooks in forest. Sask.: 4250. Alta.: 5636.

Orthocarpus luteus Nutt. Common on dry prairie. Sask.: 4611.

Pentstemon albidus Nutt. Occasional on dry hills. Sask.: 5449.

P. nitidus Dougl. Frequent on dry eroded banks. Sask.: 4321.

P. procerus Dougl. Common in meadows on the plateau. Sask.: 4316. Alta.: 14191.

Rhinanthus crista-galli L. (*R. kyrolae*, *R. rigidus* Chab.) Frequent in dry semi-wooded areas. Sask.: 5712. Alta.: 5290.

Veronica americana Schw. Common in springy places. Sask.: 4644.

V. comosa Richter (*V. catenata*, *V. connata* Pennell) Occasional in shallow streams. Sask.: 4687.

V. peregrina L. var. **xalapensis** (H.B.K.) Pennell (*V. xalapensis* H.B.K.) Scarce; in meadow on the plateau. Sask.: 5053.

V. serpyllifolia L. Scarce; in springy places. Sask.: 4357.

LENTIBULARIACEAE

Utricularia minor L. Shallow water in Twin Lakes, Alta.: 5265.

U. vulgaris L. var. **americana** A. Gray (*U. macrorrhiza* Le Conte) Occasional in ponds. Sask.: 4601. Alta.: 5282.

OROBANCHACEAE

Orobanche fasciculata Nutt. (*Thalesia fasciculata* (Nutt.) Britton) Scarce; on dry hills; prairie. Sask.: 5153. Alta.: 5087.

O. ludoviciana Nutt. (*Myzorrhiza ludoviciana* (Nutt.) Rydb.) Rare; on dry hills; prairie. Sask.: 5401.

PLANTAGINACEAE

Plantago elongata Pursh Dry hillside; prairie. Sask.: Cypress Hills, Macoun 19803. (Can).

P. major L. Common roadside weed; introduced. Sask.: 4494.

P. purshii Roem. & Schult. Dry soil in valley. Sask.: Cypress Hills, Macoun 70929 (Can).

RUBIACEAE

Galium boreale L. Common in grassland on the plateau. Sask.: 4446.

G. trifidum L. Occasional in wet meadows. Sask.: 4252.

G. triflorum Michx. Occasional in damp shaded places. Sask.: 4251. Alta.: R. G. H. Cormack 466 (UnA).

CAPRIFOLIACEAE

Linnaea borealis L. var. **americana** (Forbes) Rehder (*L. americana* Forbes) Abundant in pine forest. Sask.: 4503.

Symphoricarpos albus (L.) Blake (*S. racemosus* Michx.; *S. pauciflorus* (Robbins.) Britton) Common in aspen woods. Sask.: 4564.

S. occidentalis Hook. Common in valleys. Sask.: 4809.

Viburnum edule (Michx.) Raf. (*V. pauciflorum* Pylaie; *V. eradiatum* (Oakes) House) Frequent in pine and aspen woods. Sask.: 4229.

V. trilobum Marsh. (*V. opulus* L. var. *americanum* (Mill.) Ait.) Occasional in rich aspen woods. Sask.: 4369.

CAMPANULACEAE

Campanula rotundifolia L. (*C. petiolata* A. DC.; *C. intercedens* Witasek.) Common in grassland on the plateau. Sask.: 4614.

COMPOSITAE

Achillea millefolium L. ssp. *lanulosa* (Nutt.) Piper (*A. lanulosa* Nutt.) Frequent in the fescue grassland. Sask.: 4326. Alta.: 14196.

Actinea acaulis (Pursh) Spreng. (*Tetranneuris acaulis* (Pursh) Greene; *T. septentrionalis* Rydb.) Sask.: Cypress Hills, Macoun 5078 (Can).

Agoseris glauca (Pursh) Raf. var. *scorzoneræfolia* Schrad. (*A. agrestis* Osterh.) Common in grassland. Typical *A. glauca* (*A. parviflora*) possibly occurs in moist meadows within the area and is distinguished as being glabrous; leaves 2-8 mm. wide; involucre 10-15 mm. high. The var. *scorzoneræfolia* is more or less pubescent, at least on the involucre; leaves 8-30 mm. wide; involucre 15-30 mm. high. Sask.: 4442. Alta.: 13740.

Ambrosia trifida L. River banks and moist soil. Sask.: Cypress Hills, Macoun, 11410 (Can).

Anaphalis margaritacea (L.) Benth & Hook. var. *subalpina* A. Gray (*A. subalpina* (A. Gray) Rydb.) Scarce; in pine woods. Sask.: 8073. Alta.: 5583.

Antennaria anaphaloides Rydb. Scarce; in grassland on the plateau. Sask.: 4215. Alta.: 5090.

A. aprica Greene Frequent on dry hills; grassland. Sask.: 4217.

A. campestris Rydb. (*A. athabascensis*, *A. lunellii* Greene) Occasional on prairie and edge of woods. Sask.: 4196.

A. corymbosa E. Nels. Occasional in open pine and aspen woods. Sask.: Cypress Hills Park, 4411. Alta.: Elkwater Lake, 14197.

A. howellii Greene Common in dry pine woods. Sask.: 4198. Alta.: 5664.

A. microphylla Rydb. (*A. nitida* Greene; *A. parvifolia* Greene, not Nutt.; *A. bracteosa* Rydb.) Common on dry prairie. Sask.: 4434. Alta.: 13730. Heads nodding when young. Staminate and pistillate plants equally common.

A. obovata E. Nels. Common in open pine woods. Sask.: 4181. Alta.: 5663.

A. oxyphylla Greene Occasional in open pine woods. Sask.: 4214.

A. reflexa A. Nels. (*A. aizoides* Greene; *A. flavescens* Rydb.) Occasional on dry exposed gravelly hillsides. Sask.: 4219.

A. rosea Greene Frequent in open pine woods and grassland on the plateau. Sask.: 4197.

A. rosea Greene var. *imbricata* E. Nels. (*A. imbricata* E. Nels.) Scarce; in woods on the plateau. Sask.: 4416. Alta.: 13738.

Arctium minus Schk. Introduced roadside weed. Sask.: 4702.

Arnica chamissonis Less. Scarce; in moist meadows and open woods. Sask.: 4797. Alta.: 5564.

A. cordifolia Hook. Common in pine woods. Sask.: 4186.

A. fulgens Pursh Very common in grassland on the plateau. Sask.: 4194.

Artemisia biennis Willd. Rare; in damp shaded place. Sask.: Battle Creek Ranger Station, 5711.

A. cana Pursh Occasional on dry exposed hillsides. Sask.: 5387. Alta.: 5601.

A. dracunculoides Pursh (*A. glauca* Pall. var. *dracunculina* (S. Wats.) Fern.) Occasional on dry prairie. Sask.: 5051.

A. forwoodii S. Wats. (*A. camporum*, *A. bourgeauana* Rydb.) Occasional on dry exposed hills; prairie. Sask.: 4773.

A. frigida Willd. Common on dry exposed hillsides. Sask.: 4974.

A. gnaphalodes Nutt. (*A. ludoviciana* Nutt. var. *gnaphalodes* (Nutt.) Torr. & Gray; *A. diversifolia* Rydb.) Common on prairie. Sask.: 4995.

A. longifolia Nutt. Occasional on dry eroded hillsides. Sask.: 5405.

A. pabularis (A. Nels.) Rydb. (*A. ludoviciana* Nutt. var. *pabularis* (A. Nels.) Fern.) Scarce; on dry prairie. Sask.: 5405. Alta.: 5639.

Aster adscendens Lindl. (*A. subgriseus* Rydb.) Occasional on prairie. Sask.: 5102. Alta.: 5588.

A. canescens Pursh (*Machaeranthera canescens* (Pursh) A. Gray) Scarce; on dry prairie. Sask.: Eastend, 5463.

A. ciliolatus Lindl. (*A. lindleyanus* Torr. & Gray; *A. wilsonii* Rydb.) Common in aspen woods. Sask.: 4905. Alta.: 5562.

A. coerulescens DC. (*A. osterhoutii*, *A. ciliomarginatus* Rydb.) Occasional in low meadows. Sask.: 5412. Alta.: 5505.

A. commutatus Torr. & Gray (*A. adsurgens* Greene; *A. crassulus* Rydb.; *A. exiguus* (Fern.) Rydb.) Occasional on dry prairie. Sask.: 5680. Stems from creeping underground rhizomes.

A. conspicuus Lindl. Common in pine and aspen woods. Sask.: 4934. Alta.: 5576.

A. ericoides L. (*A. multiflorus* Ait.; *A. stric-ticaulis* (Torr. & Gray) Rydb.) Occasional on dry hills; prairie. Sask.: 5409. Stems caespitose from a crown.

A. junciformis Rydb. (*A. junceus* Am. auth., not Ait.) Occasional in boggy places. Sask.: 4940. Alta.: 5269.

A. laevis L. (*A. geyeri* (A. Gray) Howell) Common on dry prairie. Sask.: 4890.

A. oregonus Nutt. (*A. mearnsii* Rydb.) Frequent in moist coniferous woods. Sask.: 5424. Alta.: 5588.

A. ptarmicoides (Nees) Torr. & Gray (*Unamia alba* (Nutt.) Rydb.) Sask.: Cypress Hills Park, L. T. Carmichael 187 (Can).

Bidens cernua L. (*B. glaucescens* Greene) Occasional along creeks. Sask.: 5687.

Chrysopsis hispida (Hook.) Nutt. Sask.: Cypress Hills, W. Shevkenek, July, 1939 (DAO).

C. villosa (Pursh) Nutt. (*C. camporum* Greene; *C. bellardii* Rydb.) Common on dry hills. Sask.: 4976.

Chrysothamnus nauseosus Nutt. (*C. frigidus* Greene) Occasional on eroded banks. Sask.: 5362. Alta.: 5600.

Cirsium arvense (L.) Scop. Introduced weed in waste places. Sask.: 4936.

C. undulatum (Nutt.) Spreng. Occasional in grassland. Sask.: 5036.

C. vulgare (Savi) Tenore (*C. lanceolatum* Scop., not Hill) Introduced roadside weed; occasional. Sask.: 4906.

Crepis exilis Osterhout Alta.: Cypress Hills, Macoun in 1884. See Carnegie Inst. Wash. Pub. 504: 168, 1938.

C. intermedia A. Gray Sask.: Cypress Hills, Macoun 5080 (Can).

C. occidentalis Nutt. Sask.: Farwell Creek, Cypress Hills, Macoun, 11709 (Can).

C. platyphylla Greene (*C. runcinata* (James) Torr. & Gray var. *hispidulosa* Howell) Frequent in submontane grassland. Sask.: 4439. Alta.: 14195.

C. runcinata (James) Torr. & Gray (*C. glau-cella*, *C. perplexans* Rydb.) Occasional in moist prairie. Sask.: Eastend, R. A. Wilkin-son, July 30, 1942 (DAO).

Coreopsis tinctoria Nutt. Low moist prairie. Sask.: 6634.

Erigeron caespitosus Pursh Common on dry hills; prairie. Sask.: 4812.

E. canadensis L. (*Leptilon canadense* (L.) Britton) Roadside through pine woods. Sask.: 5377.

E. compositus Pursh *E. trifidus* Hook.) Occasional on dry exposed hills. Sask.: 5156. Alta.: 5263.

E. droebachiensis Müll. (*E. acris* L. var. *asteroides* (Andrz.) DC.; *E. angulosus* Gaudin) In burnt pine woods. Alta.: 5581.

E. drummondii Greene (*E. oligodontus* Lunell) Scarce; on dry hillsides; prairie. Alta.: 5091.

E. glabellus Nutt. Common in woods and open meadows. Sask.: 4635. Alta.: 5513.

E. lonchophyllus Hook. (*E. minor* (Hook.) Rydb.) Scarce; in damp places. Sask.: 5175. Alta.: 5270.

E. ochroleucus Nutt. var. *scribneri* (Canby ex Rydb.) Cronq. (*E. macounii* Greene). Sask.: Cypress Hills, Macoun, June 28, 1894. (Can).

E. philadelphicus L. Scarce; in damp meadows. Sask.: 4841.

E. radicans Hook. (*E. peucephyllus* sensu Macoun (23) as to report from the Cypress Hills) Scarce; on dry, exposed hills. Sask.: 5046.

Gaillardia aristata Pursh Common on the plateau in grassland. Flowers of unusual size, up to 4 inches across, have been measured here. Sask.: 4327.

Grindelia squarrosa (Pursh) Dunal (*G. perennis* A. Nels.) Common in moist meadows. Sask.: 4896.

Gutierrezia diversifolia Greene Occasional on dry hills. Sask.: 5214.

Helianthus fascicularis Greene Occasional in moist meadows. Sask.: 4901. Alta.: 5506.

H. lenticularis Dougl. (*H. annuus* A. Gray, in part, not L.) Dry soil. Sask.: 5374.

H. petiolaris Nutt. (*H. aridus* Rydb.) Sask.: Cypress Hills, W. Shevkenek, July 1939 (DAO).

H. rigidus (Cass.) Desf. (*H. subrhomboides* Rydb.) Common on dry hills and prairie. Sask.: 4749.

Hieracium albiflorum Hook. Common in open pine woods. Sask.: 4467. Alta.: 5576.

H. canadense Michx. (*H. scabriusculum* Schw.; *H. columbianum* Rydb.; *H. umbellatum* Am. auth., not L.; *H. cynoglossoides* sensu Fraser and Russell) Common on open hillsides and in pine woods. Sask.: 5684. Alta.: 5657.

Hymenoxys richardsonii (Hook.) Cockerell (*H. macounii* (Cockerell) Rydb.) Occasional on dry hills and prairie. Sask.: 5040. Alta.: 13734.

Iva xanthifolia Nutt. (*Cyclachaenia xanthifolia* (Nutt.) Fresen) Weed in waste places. Sask.: Boyd's Ranch, 5349.

Lactuca pulchella (Pursh) DC. Occasional on dry banks. Sask.: 4780.

L. scariola L. Roadside weed; introduced. Sask.: 4850.

L. spicata (Lam.) Hitchc. (*L. biennis* (Moench) Fern.) Scarce; in wet woods. Sask.: 4479.

Lepachys columnifera (Nutt.) Rydb. (*Ratibida columnaris* (Sims.) D. Don) Occasional on dry hillsides; prairie. Sask.: 4858.

Liatris punctata Hook. (*Laciniaria punctata* (Hook.) Kuntze) Common on dry hills; prairie. Sask.: 4972. Alta.: 5552.

Lygodesmia juncea (Pursh) D. Don Occasional on dry hills; prairie. Sask.: 4697.

L. rostrata A. Gray In moist sandy soil. Cypress Hills, Sask.: Macoun, 15189, (Can).

Madia glomerata Hook. Roadside weed; ill-scented. Sask.: 4851. Alta.: 5293.

Matricaria matricarioides (Less.) Porter (*Chamomilla suaveolens* (Pursh) Rydb.) Common dooryard weed. Sask.: 4524.

Petasites palmatus (Ait.) A. Gray Scarce in damp woods. Sask.: 5061.

P. sagittatus (Pursh) A. Gray Scarce; in swamps. Sask.: 4653.

P. vitifolius Greene (*P. trigonophylla* Greene) Scarce; in rich woods. Alta.: 5555.

Pyrrocoma lanceolata (Hook.) Greene (*Haplopappus lanceolatus* (Hook.) Torr. & Gray) Moist meadows at lower elevations. Sask.: The Gap, 5375.

Rudbeckia serotina Nutt. (*R. hirta* of Amer. auth., not L.) Scarce; on dry soil in valleys. Sask.: 5252.

Senecio canus Hook. (*S. purshianus* Nutt.) Common on dry hills; prairie. Sask.: 4443.

S. indecorus Greene (*S. pseud aureus* Rydb.; *S. burkei* Greenm.) Occasional in damp woods and thickets. Sask.: 4313. Alta.: 5659.

S. exaltatus Nutt. (*S. columbianus* Greene) Occasional in damp meadows. Sask.: 4544.

S. integerrimus Nutt. Alta.: Elkwater Lake, H. Groh, June 9, 1931 (DAO).

S. multnomensis Greenm. (*S. plattensis* and *S. tweedyi* sensu Fraser and Russell as to Cypress Hills specimens) Scarce; grassland near willow thicket. Alta.: Spring Creek Ranger Station, 14440.

S. pauperculus Michx. (*S. balsamitae* Muhl.) Frequent in grassland on the plateau. Sask.: 4987.

S. scribneri Rydb. Scarce; hillside. Sask.: Eastend, A.C. Budd, May 27, 1938. (DASC).

Sideranthus grindelioides (Nutt.) Britton (*Haplopappus nuttallii* Torr.) Occasional on dry hills; prairie. Sask.: 5043.

S. spinulosus (Pursh) Sweet (*Haplopappus spinulosus* (Pursh) DC.) Frequent on dry hills at lower elevations. Sask.: 5237.

Solidago decumbens Greene var. **oreophila** (Rydb.) Fern. (*S. oreophila* Rydb.) Occasional on dry hills and prairie. Sask.: 4826. Alta.: 5524.

S. pruinosa Greene (*S. dumetorum* Lunell; *S. lunellii* Rydb.; *S. gilvocanescens* (Rydb.) Smyth, nomen nudum) Dry ground. Sask.: Frenchman River valley, Eastend, 5465.

S. lepida DC. (*S. elongata* Nutt.) Common in moist wooded valleys. Sask.: 4893.

S. missouriensis Nutt. Common on dry hills and plains. Sask.: 4769. Alta.: 13761.

S. mollis Bartl. Scarce; dry soil on prairie. Sask.: 5339.

S. nemoralis Ait. var. **decemflora** (DC.) Fern. (*S. pulcherrima* A. Nels.) Occasional on the plateau in grassland. Sask.: 4931.

S. rigida L. (*Oligoneuron rigidum* (L.) Small; *O. canescens* Rydb.) Very common on prairie. Sask.: 5002. Alta.: 5596.

S. serotina Ait. (*S. gigantea* Ait.) Frequent in wooded valleys. Sask.: 4891.

Stenotus armerioides Nutt. (*Haplopappus armerioides* (Nutt.) A. Gray; *H. caespitosus* sensu Macoun, Cat. Can. Plants, 210, 1883-90; *H. acaulis* (Nutt.) A. Gray var. *glabratus* sensu Hall in Carnegie Inst. Wash. Publ. No. 389, 166-7, 1928, as to citations from Saskatchewan) Scarce; on dry hills. Sask.: Eastend, 5442.

Taraxacum officinale Weber Common roadside weed; introduced. Sask.: 4538.

Townsendia exscapa (Richards.) Porter (*T. sericea* Hook). Occasional on dry eroded hillsides. Sask.: 5045. Alta.: 5258.

Tragopogon dubius Scop. Occasional on dry hillsides. Introduced weed. Sask.: 4320.

Xanthium echinatum Murr. (*X. glanduliferum*, *X. varians* Greene). Occasional along streams and waysides. Sask.: 5481. Alta.: 5554.

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APPENDIX

Recent studies have indicated the following nomenclatural and taxonomic changes in the foregoing catalogue:

For *Poa nevadensis* Vasey substitute *Poa ampla* Merr.

Delete *Allium stellatum* Ker. The specimen cited is considered to be *Allium textile* Nels. & Macbr.

For *Betula fontinalis* Sarg. substitute *Betula occidentalis* Hook.

For *Arenaria congesta* Nutt. substitute *Arenaria capillaris* Poir. ssp. *americana* Maguire.

For *Anemone multifida* Poir. var. *globosa* (Nutt.) Torr. & Gray substitute *Anemone multifida* Poir. var. *richardsoniana* Fern.

For *Lesquerella alpina* Torr. substitute *Lesquerella alpina* Torr. var. *spathulata* (Rydb.) Payson.

For *Lesquerella ludoviciana* (Nutt.) S. Wats. substitute *Lesquerella arenosa* (Richards.) Rydb.

For *Astragalus caespitosus* (Nutt.) A. Gray substitute *Astragalus spatulatus* Sheld.

For *Petalostemon candidus* (Willd.) Michx. substitute *Petalostemon candidus* (Willd.) Michx. var. *occidentale* A. Gray.

For *Linanthus harknesii* (Curran) Greene substitute *Linanthus septentrionalis* H. L. Mason.

For *Aster commutatus* Torr. & Gray substitute *Aster falcatus* Lindl. var. *crassulus* (Rydb.) Cronq.

For *Aster ericoides* L. substitute *Aster pansus* (Blake) Cronq.

For *Helianthus rigidus* (Cass.) Desf. substitute *Helianthus laetiflorus* Pers. var. *subrhomboideus* (Rydb.) Fern.

For *Hieracium canadense* Michx. substitute *Hieracium umbellatum* L. var. *scabriusculum* (Schw.) Farwell.

For *Rudbeckia serotina* Nutt. substitute *Rudbeckia hirta* L.

Senecio multinomensis Greenm. should be included as a synonym of *Senecio indecorus* Greene.

For *Solidago rigida* L. substitute *Solidago rigida* L. var. *humilis* Porter.

NOTICE

The Annual Meeting of the Ottawa Field-Naturalists' Club will be held December 2, 1954, at 8.15 p.m. in the Ottawa Normal School.

NOTES AND OBSERVATIONS

The Prairie Chicken nesting at Gore Bay, Manitoulin Island. — The Pinnated Grouse or Prairie Chicken *Tympanuchus cupido* (Linnaeus) is a western species that during the past several decades has been moving eastward and occupying the St. Mary's River and Manitoulin Island region of Ontario. This incursion has been recorded by Baillie (1947).

During the summer of 1948 Misses R. W. Braffette and D. K. Brown of the Ontario Department of Lands and Forests and University of Toronto respectively, made an extensive survey of Manitoulin and adjacent islands to determine the status of the Prairie Chicken and its utilization of existing types of habitat (Ms. unpublished). Although no nests were found, breeding evidence was secured when four half-grown young were discovered in a hay field in Billings township in July 1948. Several photographs were taken of the young birds.

Lumsden (1949) studied this species during January and February near Gore Bay, and again during April and May 1949, when a more detailed survey was made of booming grounds throughout the island (Ms. unpublished).

On June 19-20, 1953, the writers were afforded the opportunity of studying the Prairie Chicken in the Gore Bay — Barrie Island vicinity. During the course of the survey, at the airport seven miles west of Gore Bay, D. S. Miller flushed a female Prairie Chicken from a nest of three eggs. The nest was situated in a depression some three inches below the surrounding ground level and was sparsely lined with dried grass. Arched over the nest partially concealing the eggs was a tuft of grass about 15 inches long. The eggs which were quite fresh were of a pale pinkish-buff colour and measured 44.0 by 30.5, 44.5 by 31.9 and 47.0 by 32.0 millimeters respectively. The set has been deposited in the collection of the Royal Ontario Museum of Zoology and Palaeontology.

The nesting habitat consisted of dry, stony flatland with very thin alkaline soil over Lorraine — Richmond limestone. Vegetation noted in the immediate vicinity of the nest was: Canada Blue-grass, *Poa compressa* L.; Foxtail, *Setaria* sp.; Low Hop-clover, *Trifolium procumbens* L.; Alsike

Clover, *Trifolium hybridum* L.; Daisy Fleabane, *Erigeron annuus* L.; Common Yarrow, *Achillea Millefolium* L.; Long-beaked Willow, *Salix bebbiana* Sarg.; Goldenrod, *Solidago* sp.; Virginia Strawberry, *Fragaria virginiana* Duchesne.

Birds other than Prairie Chickens noted in the same general area included Upland Plover, *Bartramia longicauda*; Savannah Sparrow, *Passerculus sandwichensis*; Eastern Meadowlark, *Sturnella magna*; Horned Lark, *Eremophila alpestris*; Song Sparrow, *Melospiza melodia*; Sparrow Hawk, *Falco sparverius*; Great Blue Heron, *Ardea herodias*; Purple Martin, *Progne subis*; Barn Swallow, *Hirundo rustica*; Eastern Kingbird, *Tyrannus tyrannus*; Crow, *Corvus brachyrhynchos*; American Goldfinch, *Spinus tristis*.

The late date for this nest of fresh eggs would seem to indicate that it was a second attempt after the first clutch had been destroyed.

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O. E. DEVITT and D. S. MILLER
Ontario Dept. of Lands and Forests, Toronto.

A breeding record of the Solitary Sandpiper in central British Columbia. — On July 1, 1951, I collected a downy young Solitary Sandpiper (*Tringa solitaria*) at Heart Lake, 47 miles north of Prince George in central British Columbia. This is apparently the first substantiated breeding record for the province.

On the evening of June 29 the alarm notes of this species first attracted my attention to a small, marshy depression separated from the lake by about 150 yards of open pine woods. Two adults were present; one was particularly agitated and came within a few feet of me, calling incessantly and "teetering" on the branches of dead willows. At dusk on July 1, there were three adults but again only one became excited. The other two joined in a fretful chorus but did not fly up into the trees to watch my move-

ments. Searching for the young birds in the tangled grass appeared at first to be a hopeless task but one chick's feeble squeaks, like ventriloquial echoes of its parent's cries, finally led to its discovery in a deep hollow beneath some willow roots. Its age was estimated at less than a week, as the feathers had not begun to show through the natal down.

J. GRANT, R.R. 2, Vernon, B.C.

Food Habits of Lake Trout from Squaw Lake, Northern Quebec. — During the summer of 1952, the writer was engaged in herpetological studies in northern Quebec Province. A camp site was established on the north shore of Squaw Lake, a large lake which is approximately one mile north of Knob Lake, the terminus of the Quebec-Labrador iron ore railway project.

The north shore margin of Squaw Lake is barren of macroscopic aquatic plants and the bottom, composed of broken slate, is easily visible through the clear water. As a consequence of such relative barrenness competition amongst fish for food is intense. This is evident by their poor condition, for lake trout measuring 19, 24, and 27 inches weighed only 1- $\frac{3}{4}$, 3, and 5- $\frac{1}{2}$ pounds respectively.

Before and during the spring ice break-up, the stomach contents of lake trout (*Cristivomer namaycush namaycush*) consisted of fish remains and aquatic invertebrates. However, as the fly season progressed, fewer traces of fish and more masses of mosquitos were dissected from stomachs. Of thirteen lake trout caught in the period June 28 to July 7 only one had fish remains in its stomach, the other twelve having the stomach plugged with insects. Trout as large as twenty-seven inches in length were found subsisting on mosquitos and mosquito larvae. Large trout are recognized as being almost exclusively piscivorous so it was most interesting to open a firm eight inch stomach and find its distention due entirely to innumerable mosquitos and mosquito larvae.

On July 1 a 24- $\frac{1}{8}$ inch (3 pounds) lake trout was hooked on a light fly rod, using

bait and spinner, but contrary to previous catches it offered no resistance to being reeled in and netted. Members of the party remarked that it must be "sick". Examination of the stomach contents verified this suggestion for a large triple hook was embedded in the stomach wall and attached to it were five inches of wire leader and ten inches of line. In addition to this there were only a few caddis fly larvae indicating that this fish had been feeding on relatively inactive prey at the lake bottom.

SHERMAN BLEAKNEY,
National Museum of Canada,
Ottawa, Ontario.

A KILLIFISH IN MANITOBA. — While engaged in general collecting in the Red River at the campus of the University of Manitoba in July, 1948, the writer netted two small fish of unfamiliar appearance close to the water's edge. Placed in an aquarium already containing a number of tropical fish (guppies), one soon disappeared, but the other increased in length from approximately 15mm. to 32 mm. in the course of two months. It was then an alert and savage little fish whose protruding lower jaw, dark bars on a silvery background, rounded tail, and other features clearly showed it to be a Cyprinodont, a family hitherto unrecorded in Manitoba. Unfortunately it died over a hot week-end, and when found was markedly emaciated and somewhat damaged, especially as regards the tail-fin and the outer surface generally. However, the structures remaining are quite sufficient to identify it readily as the Western Banded Killifish, *Fundulus diaphanus menona*, a form recorded widely for Minnesota but not recorded in Ontario north or west of the Spanish River and never listed for Manitoba as far as can be ascertained. Publication of this new record has been delayed in the hope that further specimens would be secured, but casual observations have been without result.

The specimen has been deposited in the Manitoba Museum, Winnipeg.

R. K. STEWART-HAY,
Assistant Professor of Zoology,
University of Manitoba.

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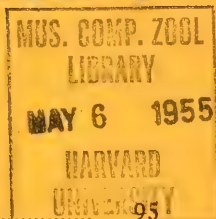
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The CANADIAN FIELD-NATURALIST

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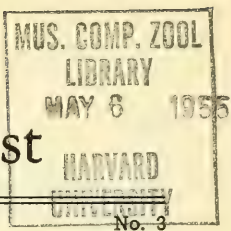
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SMALL MAMMAL POPULATIONS IN NORTHERN BRITISH COLUMBIA¹

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MANY FOOD HABITS studies have shown that small mammals provide an important part of the diets of valuable fur animals. A fur resource survey in the region of Fort Nelson, British Columbia² indicated a need for an estimate of small mammal populations to aid in appraising the ability of the region to support a fauna of fur animals.

Estimates of "mouse" populations were made by snap-trapping sample plots. The region considered in this study is an area of about 20,000 square miles. Because of the size and inaccessible character of the region sampling was necessarily extensive. Some of the plots are located within a few hours walk of the Indian village at old Fort Nelson. Trapping was also done in foothill and mountainous sections along the Alaska Highway to obtain a wider distribution of sampling. Plots were marked so that they might be re-located for future study but were trapped only once each.

Sampling was done during the fall periods of 1947 and 1948. Mouse populations were considered to be most stable during the late fall and therefore trapping was confined to this period.

The study plots were chosen by inspection to represent the major cover types and physiographic zones found in the region. All of the major cover types occurred in each of the principle physiographic zones. The cover types sampled were described as follows:

1. Black spruce: *Picea mariana*; locally called "dog hair spruce" because of its density; generally in a pole stage, but not necessarily young.
2. White spruce: *Picea glauca*; usually large dominant trees on lower bench lands of rivers.

3. Muskeg: open areas dominated by ericaceous and lichen-moss growth with scattered black spruce and larch *Larix* sp. trees. Muskeg is also used as a physiographic term.
4. Cottonwood: *Populus balsamifera*; large trees occurring on lower river benches and also medium sized trees in the foothills.
5. Aspen — birch: *Populus tremuloides* and *Betula papyrifera*; generally young stands representing a secondary stage of succession following fire.
6. Alder-birch-willow: *Alnus* — *Betula* — *Salix*; dense thickets on low wet ground, areas locally called "prairies" and along streams.

METHODS

Much of the literature describes the home ranges of small mammals as being roughly circular. A theoretical distribution pattern of animals might, therefore, be viewed as a grid of contingent circular areas. A sample area in the form of a square seemed to best encompass a series of contingent circles, and for the purpose of this study, a square of one acre seemed adequate. A grid pattern of traps was distributed over the sample area with the intention of providing a trap for each hypothetical home range on the plot. Burt's (1) studies have suggested an optimum spacing of 45 feet for trapping some small mammals. Spacing traps 42 feet apart permits setting a grid of 25 traps per acre and this closely approximates Burt's recommendation. This interval allows for a buffer zone patrolled by the peripheral traps.

Live trapping experiments conducted by Burt have shown that most of the resident small mammals can be trapped in three or four nights. Therefore, the sample plots were trapped for three or four nights depending on the performance of the traps. If

¹ Received for publication February 15, 1954.
² Quick, Horace F., Fur resources of a wilderness region, U.S. Office of Naval Research, Project ONR 5, 1950, (Administered by The Arctic Institute of North America).

the initial night of trapping yielded a number of specimens and subsequent nights did not, trapping was discontinued. If catches were sustained over three nights, the traps were left for a fourth night. Further, if catches occurred only at peripheral stations after the third night, this was taken to be evidence of the depletion of the resident population. Trapping was then discontinued to avoid catching animals which might move into the habitable area recently evacuated by the removal of animals. From these ideas it has been assumed that the animals taken from each of the plots in the three or four night trapping periods constituted the total resident population of the respective plots. Since the plots were each one acre in area, the number of animals caught have been presumed to be a reasonable estimate of density in terms of number of animals per acre.

In 1948 Calhoun (2) described a standardized sampling method and this method was tried. Groups of three traps per "station" were placed in suitable locations within a circle 5 feet in diameter. Twenty stations were established at intervals of 20 feet. A total of 60 traps were thus set for a period of 3 nights. In cases where habitat types were too small to accommodate this length of line-sample, only 10 stations were established. Density estimates are difficult to make from data obtained by this method, because it is a problem to determine the area actually sampled. The data from the two years of sampling have, therefore, been reduced to common terms in which the number of animals caught per 100 trap-nights is used for comparison of population levels.

RESULTS AND DISCUSSION

A total of 3,057 trap-nights resulted in the capture of 350 small mammals from 25 sample areas. Three species were taken, most abundant of which was the red backed vole (*Clethrionomys gapperi athabascaae*). White footed mice (*Peromyscus maniculatus borealis*) and shrews (*Sorex* sp.) were respectively second and third in abundance. Meadow voles (*Microtus* sp.) and chipmunks (*Eutamias* sp.) were collected at other locations, but these were not found on the sample plots.

An analysis of the data obtained in 1947 from square sample plots showed a marked pattern of trap performance. Several distinct tendencies were observed. In cases where small rodents were detected, they were readily taken on the first night of

trapping. More rodents were always caught the first night than on succeeding nights as might be expected. Trapping did not reveal rodents on some of the plots, but shrews were usually found to be present during 1947. However, the shrews were not always caught on the first night of trapping as were rodents when present. It was usually necessary to trap two or more nights in order to catch shrews. Shrews often ate parts of mice which had been caught and on the night following the clearing of these traps shrews were usually caught.

The data obtained in 1948 by means of the Rodent Ecology Project method of sampling did not readily permit recognition of the trap performance tendencies noted in 1947. This was primarily because the line-station method was difficult to relate to two-dimensional phenomena. However, some of the same tendencies observed in square plot sampling could also be detected in the line-station method of sampling. Rodents were either exclusively or preponderantly taken on the first nights of trapping if they were at all present. As trapping continued, the numbers of animals caught per night decreased on successive nights.

Changes in population levels between 1947 and 1948 influenced the proportion of species trapped. This, of course, was detected by sampling. Whether or not a differential susceptibility of these species to trapping exists is not discernible by these methods; this has been necessarily disregarded here.

ANALYSIS

Composition of the population

In 1947 shrews and red backed voles appeared to be equally abundant in the region as a whole. Deer mice were scarce by comparison. The relative abundance of these three species changed drastically in 1948. A comparison of the composition percentages from the data obtained in 1947 (Table 1) and in 1948 (Table 2) shows significant increases in rodent populations and a decrease in the shrew population. This can also be noted in Table 4 where the data are presented on the basis of animals caught per 100 trap-nights.

Information obtained by De Vos (3) during a period of time which over-lapped that of this report provides an interesting comparison of changes in populations. Table 4 shows a build-up of vole populations in the Fort Nelson region which reached a level in 1948 comparable to the vole population in

Table 1 — SMALL MAMMAL POPULATIONS

Fort Nelson Region 1947

Plot	Date 1947	Location	Habitat	Mammals Trapped				Total
				Trap Nights	Peromyscus	Clethrionomys	Sorex	
1	Oct. 3	Ft. Nelson	Aspen-Birch	25	0	7	0	7
2	Oct. 14	" "	"	100	2	8	11	21
3	Oct. 14	" "	"	100	2	8	8	18
4	Oct. 17	" "	Cotton Wood	75	0	0	3	3
5	Oct. 21	Prophet River	"	147	3	1	0	4
6	Oct. 21	"	"	75	0	0	1	1
7	Oct. 27	Ft. Nelson	Muskeg	100	0	0	0	0
8	Nov. 1	Prophet River	Cottonwood-spruce	75	0	0	1	1
9	Nov. 1	"	Cottonwood	100	1	0	0	1
10	Nov. 1	"	Mature W. Spruce	100	0	0	0	0
Totals				897	8	24	24	56
Catch Per 100 Trap Nights (nearest tenth)					0.9	2.7	2.7	6.3
Composition of Population (nearest 1%)					14%	43%	43%	

Ontario as determined by De Vos. In one year De Vos found this level to fall markedly. The decline between 1948 and 1949 found by him is very similar to the rise in population from 1947 to 1948 found in British Columbia. De Vos' data show a ratio of proportionality in vole populations of approximately one third between successive years. My data show a reciprocal ratio of proportionality of about three between successive years. It appears from these data that De Vos began his work when popula-

tions were decreasing, while my work was begun as populations were increasing. Possibly these data define the magnitude and duration of a vole cycle. When compared to the data from British Columbia it appears that De Vos' data demonstrate that maximum populations in Ontario occurred in 1948. My data show that vole and mouse populations reached a high level in British Columbia in the same year. Vole populations in both regions appeared strikingly equal when compared on the basis of animals caught per 100

Table 2 — SMALL MAMMAL POPULATIONS

Fort Nelson Region 1948

Plot	Date 1948	Location	Habitat	Trap Night	Mammals Trapped			
					Peromyscus	Clethrionomys	Sorex	Total
1	Oct. 3	Ft. Nelson Up'r Bench	Aspen- Birch	180	6	29	0	35
2	Oct. 5	"	Alder- Willow	180	3	23	0	26
3	Oct. 9	" Lower Bench	Cottonwood- spruce	180	4	23	2	29
4	Oct. 12	"	"	180	3	22	3	28
5	Oct. 12	"	Mature Spruce	180	0	15	0	15
6	Oct. 17	Alaska Rd. Mile 408	Mixed Gr. Mountainside	180	15	1	2	18
7	Oct. 17	" "	" "	180	7	1	3	11
8	Oct. 23	" "	Mixed Gr. River flat	180	30	18	0	48
9	Oct. 23	" "	" "	180	20	24	0	44
10	Nov. 6	Fort Nelson	Muskeg	90	0	7	0	7
11	Nov. 6	" "	"	90	0	5	0	5
12	Nov. 6	" "	"	90	0	4	0	4
13	Nov. 10	M. Parson Trap Line	Dense Spruce	90	6	4	0	10
14	Nov. 10	"	Lodgepole Pine	90	0	5	0	5
15	Nov. 10	"	Cottonwood	90	0	9	0	9
Totals				2,160	94	190	10	294
Catch Per 100 Trap Nights (nearest tenth)					4.3	8.8	0.5	13.6
Composition of Population (nearest 1%)					32%	65%	3%	

**Table 3 — CATCH PER 100 TRAP NIGHTS IN MAJOR HABITAT TYPES BY SPECIES
BRITISH COLUMBIA**

	Muskeg		Conifer		Cottonwood		Aspen-Birch	
	1947	1948	1947	1948	1947	1948	1947	1948
<i>Clethrionomys</i>	0	5.1	0	6.6	0.21	12.0	8.0	14.5
<i>Peromyscus</i>	0	0	0	1.6	0.88	1.5	2.0	7.5
<i>Sorex</i>	0	0	0	0	0.94	1.1	9.5	0.41

**Table 4 — TOTAL NUMBER OF ANIMALS TRAPPED PER 100 TRAP NIGHTS
(Comparison of Data obtained by DeVos and Quick)
ONTARIO AND BRITISH COLUMBIA**

	1947 Quick	1948		1949 DeVos	1950 DeVos
		Quick	DeVos		
<i>Clethrionomys</i>	2.7	8.8	9.4	3.1	1.0
<i>Peromyscus</i>	0.9	4.3	1.7	1.2	0.7
<i>Sorex</i>	2.7	0.5	0.3	0.3	0.1

trap-nights Deer mouse populations, however, appeared to have been at a much higher level in British Columbia than in Ontario.

These two studies found the same three species of small mammals to be dominant in the small mammal population. De Vos did not find any notable change in the proportion of the different species whereas I did. It seems significant that both studies agree closely on vole population levels as well as on the rates of population changes.

Habitat-population relationships

The six cover types in which the 25 sample areas were located could be grouped in four major habitat classes. These are listed in Table 3 with related population data. During the two years represented the small mammals showed a consistent preference for the aspen-birch type. This habitat seemed to be the most favorable cover type for all three species of small mammals trapped on the sample plots. Changes in relative popu-

ulations in the different cover types, however, were not uniform. Shrew populations, for example, decreased in the aspen-birch type from 1947 to 1948 while they increased in the cottonwood type during these same years. The data could be interpreted to be indicative of a peak shrew population in the aspen-birch habitat during 1947 (9.5 animals per 100 trap-nights) which declined in the aspen-birch type (0.41 animals per 100 trap-nights) in 1948. The pattern of population change in different habitats exhibited by the two rodents was more uniform. Rodent population increases in four major habitat types appeared proportional; the animals seemed to have dispersed from a favorable type into less favorable ones. Voles were evidently increasing in all habitats during the study and this sudden population expansion might have caused them to move even into muskegs which had not been occupied at all during the previous year. Mice, too, behaved in like fashion, but their popula-

tions did not reach a level high enough to force this species to move into muskegs. The absence of small mammals in muskegs during 1947 makes it seem that this habitat was not favored by small mammals. De Vos has reported also that he found fewer animals in muskegs and concluded that they were not favorable habitat.

In a rough way it might be said that four major cover types have been rated as to cover quality by the mammals themselves. Their presence or absence, relative abundance and densities by species are demonstrations of animal response to environmental factors. Some of the data infer that while a population could build up in favorable habitat and spread to less favorable habitat, a population decline could occur in the former before occurring in the latter. Shrew populations which spread to the cottonwood type after exhibiting a density center in the aspen-birch type could be said to have followed this pattern in the Fort Nelson region.

While De Vos found higher rodent populations in mixed stands, I found that the aspen-birch types seemed to be areas of optimum mouse production at the time of study. The importance of this cover type for producing a food supply for the predatory fur animals seems to have been demonstrated in British Columbia by trap-sampling. Other cover types might serve as refuges for prey species; by vasillation of population centres prey species might elude predators. This, of course, could operate only if predators by habit did not hunt certain cover types. De Vos has shown that fisher and marten tend to shun cover types which also appear to be unfavorable to smaller mammals.

These studies have shown that small mammal populations vary in different habitats. The carrying capacity of a region for all animals depends ultimately on environmental factors of which the cover type is probably most easily measured. Much depends on the proportion of different cover types in the total area of region. As cover maps are not available for the Fort Nelson region, the proportion of optimum mouse production habitat can only be estimated. Aerial photographs would, of course, provide the cheapest and most accurate measure of habitat which in turn would facilitate an appraisal of animal productivity.

An estimate of the proportion of the major habitat types has been made from a survey

of about 1,100 miles of registered trap line. The aspen-birch type is believed to have formed at least 15% of the total area of the Fort Nelson region. Because of the value of aspen to beaver, this type is continually being reduced by these animals. High beaver populations during the past decade have caused the flooding of much of the aspen-birch type. Flooding, of course, would eliminate small mammal populations. Forest fires which occur annually in the region have the effect of creating aspen-birch habitat. During the period of study high beaver populations probably destroyed more "ideal" mouse habitat than fire created. Abandonment of overused beaver impoundments probably aids the creation of aspen-birch habitat all of which might tend to regenerate a "mouse cycle". It is impossible to evaluate the effects of these changes without an accurate measurement of them. Whether these effects balance in the long run is a matter of importance to the predatory fur animals which depend for food on small mammal populations.

Population levels

The primary object of this study was to obtain an appraisal of the small mammal population because of its importance to fur animal production. Densities of small mammals were determined by the sampling methods described above. Maximum densities of 10 rodents and 11 shrews per acre were found in the best habitats (Plots 2, 3) during 1947. Voles and shrews were about equal in density and averaged 2.4 animals per acre. Mice populations were found to average about 0.8 per acre with a maximum of 3 animals per acre in what appeared to be favored habitat. The average density of all species computed from the ten study plots sampled in 1947 was found to be 5.6 animals per acre.

In 1948 rodent densities expanded tremendously. Voles increased about 300% and mice increased 400% over their respective abundance during the previous year. The densities of these species were computed by ratio and proportion using the relative abundance data for the two years and the density data for 1947 to calculate the density data for 1948. Vole populations in 1948, for example, were determined as follows:

Relative abundance in 1947	2.7 per 100 trap-nights
Density in 1947	2.4 per acre
Relative abundance in 1948	8.8 per 100 trap-nights

Table 5 — AVERAGE NUMBER OF ANIMALS CAUGHT PER 100 TRAP-NIGHTS WITH ERROR OF ESTIMATE AT ODDS OF 9 to 1: BRITISH COLUMBIA

Species 1947	Average Catch	Maximum Error of Estimate at odds 9 to 1
Peromyscus	0.885	0.568
Clethrionomys	2.679	3.299
Sorex	2.670	2.566
All species	6.234	5.150
Species 1948		
Peromyscus	4.354	2.359
Clethrionomys	8.776	2.250
Sorex	0.467	0.322
All species	13.580	3.240

Density in 1948 x per acre

Voles were thus found to have reached an average level of 7.8 animals per acre in 1948. Mice populations were determined similarly to have attained a density of 3.8 per acre and shrews declined to 0.4 per acre.

Rodents were found to have become dominant in 1948 at a level of 11.6 per acre while shrews became very scarce. The local Indians called this a "mouse year". Nearly every moccasin which was left hanging was later found to be a cache of rice or beans made by a mouse. During this winter, I was once attracted by commotion outside a tent camp. Looking out, I saw a sled dog which was chained to a tree catch two voles in rapid succession. Small mammals had not been noted in buildings at all in 1947, but in 1948 they commonly entered cabins and caches. The degree of this increase can be judged by comparing the total catches for the two years shown in Tables 1 and 2. A catch of 6.3 animals per 100 trap-nights in 1947 compared to a catch of 13.6 animals per 100 trap-nights in 1948 shows an increase of slightly more than 100 per cent.

Statistical analysis ³

Basic data in Tables 1 and 2 were analyzed to determine their statistical significances.

³ The statistical analysis was made by Dr. Harold E. Young, Department of Forestry, University of Maine, Orono, Maine.

The number of trap-nights for each sample plot were used as statistical weights for calculating the error of estimate for each species. These results appear in Table 5 expressed as number of animals caught per 100 trap-nights.

The standard error of the difference at odds of 19 to 1 was calculated to compare the total catches made in 1947 to those made in 1948. The differences in the means were found to be significant. A similar comparison between the two years was made of the separate species. Differences between populations of *Peromyscus* in 1947 versus *Peromyscus* in 1948 and between *Clethrionomys* in 1947 and *Clethrionomys* in 1948 were found to be significant. There was no statistical significance in the difference between shrew population means, however.

This analysis indicates that confidence can be placed in the rodent population means. Shrew populations might not have been properly sampled. Possibly the type of bait and method of trapping was not suitable for capturing this species.

Comparison with other population studies

Stickel (4) determined by means of live trapping that *Peromyscus* reached an estimated population of 6 or 7 adults per acre in Maryland. Populations in British Columbia were found to be 5.6 animals (three species) per acre in 1947. Burt has shown that mouse

populations are at highest levels in Michigan during the month of November. The work reported here was done during October and November, and probably also represents peak levels of populations. Burt found that *Peromyscus* populations remained quite uniform for a given month over a period of three years. The highest population of mice found by him was 12.6 per acre. This is practically equal to the level of the total small mammal population found in British Columbia in 1948. There is no drastic deviation in the population estimates reported in the studies discussed in this paper. It seems reasonable to assume that all of them represent practical estimates for the respective periods and locations to which they refer.

CONCLUSION

My efforts to evaluate the populations of small mammals were incidental to the major objectives of a broader research program (5). The publication of De Vos' study which so nearly paralleled this work in period and objective made it seem desirable to offer a comparison.

Among the deficiencies of my work is an insufficient replication in the sampling. There have been objections to snap-trapping as a means of studying populations, but there have also been objections to other means. The excellent work done by Stickel demonstrated that snap-trap methods did not give a reliable census. Stickel, however, mentioned that snap-trap methods have possibilities for development as a means of making a good relative evaluation of populations. Development of such a method should require that biologic features as well as quantitative features of the problem be considered. An

essential biologic feature is the home range of the species under investigation while quantitative features have to do with trap spacing and control of sample area (Hayne, 6). Variations in population characteristics bid always to be step ahead of the investigator. Even live-trap methods will be challenged by natural events to provide accurate estimates of small mammal populations. Probably, live-trap sampling will always be needed to monitor snap-trap methods of population measurements, but for extensive field work the latter offer practical means of censusing small mammals.

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ADDITIONAL BIRDS FROM EASTERN GASPE¹

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WHILE RESIDING at Grande Grève, I recorded from the Forillon 117 bird species (Ball, 1938). To these, 37 species were added in 1943 (Ball, 1943). Fifteen others that have since come to my attention are recorded below. Most of these were observed in the northeastern part of the peninsula, south and west of Gaspé Bay. Included are one permanent resident, eight summer residents, two migrants, three accidental visitants, and one that may be regarded as a potential winter visitant. From the total, 169, it will appear below that I have withdrawn as hypothetical the 1936 record of the Red-shouldered Hawk.

Included in this paper are notes that help to bring up-to-date the status of 22 species previously recorded, and also remarks on another that, because of its distribution, may be expected to appear in eastern Gaspé.

Sojourn at Sandy Beach on the south side of Gaspé Bay since 1946 has provided daily opportunity to observe the distribution, population, and migration of birds over an area of approximately 2 square miles, from the shore to Millbrook Valley on the west. In 1935 a forest fire destroyed much of the coniferous forest behind the cleared land along the bay. About isolated clumps of unburned spruces, firs, and pines this area now presents a varied cover of blueberries, brakes, and deciduous saplings. Among them coniferous seeds germinate each year. The oldest are now some 15 feet high — denser near the forest margin.

Very little wet ground exists on the slopes and plateau-like top of the 300-foot hill. Only on the flat base of the low, narrow bar that extends 2 miles into the bay is marshland available to birds. Much of this is salt marsh, inundated at high tide. Left exposed are about 5 acres of fresh-water marsh bordering the base of the 20-foot bank that leads to cultivated fields above. Tree cover on this bank resembles that on the hill beyond. Thus, Sandy Beach provides sandy shore, salt and fresh marsh, open fields, coniferous forest, and a rapidly regenerating burned area. Door-yard shrubs, fruit trees, and vegetable gardens attract several species of birds.

Less thorough study was given the terrain along the entire south shore of Gaspé Bay.

During spring and summer leisurely drives were made to the headwaters of the York and St. John rivers, and less extended ones along the Dartmouth. Study of selected areas in their valleys was carried out. Through the cooperation of the Parks Service, periods of a week or 10 days each fall were spent in the Parc de la Gaspésie. Migrational studies here were directed chiefly to the valleys of the Ste. Anne and Cascapédia rivers, with briefer visits to Mt. Albert and Tabletop in the highest Shickshocks. In September 1950, 1951, and 1952, a total of more than three weeks was devoted to Lake Ste. Anne and its flanking mountains, Lyall and Sterling. In pursuance of this work annual trips around the entire peninsula provided opportunities to observe briefly the bird fauna of several peripheral localities (Ball, 1952).

Anas acuta tzitzihua. Pintail. — About July 20, 1940, L. M. Terrill (1943) found a brood with their mother in a marsh near the Malbay. This is the first breeding record for Gaspé. The early autumn appearance of Pintails in the marshy areas at the head of the York River estuary suggest that this species may nest there also.

On Anticosti Island, June 5, 1940, Lewis (1941) found on a small pond in a wooded swamp four Pintails, including a nervous female and at least two adult drakes. In the light of Terrill's discovery the Anticosti ducks may have been preparing to breed.

Aythya collaris. Ring-necked Duck. — Female (Cat. no. 415, Peabody Mus. Nat. Hist., Yale Univ.) shot out of a flock of six on York River estuary September 25, 1947. First Gaspé record. Schmitt collected one on Anticosti Island May 26, 1902 (Lewis, 1924) and another was taken north of the island at Mingan, Quebec, October 25, 1945 (Springer, 1949). Godfrey (*in litt.*) informs me that since 1947 considerable numbers of ring-necks have been banded near Baie Johan Beetz on the north shore of the Gulf of St. Lawrence. In Maine it has increased rapidly during the last few years. Palmer (1949) regarded it as a fairly common summer

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resident, especially in the easternmost county, Washington. Emphasizing the recent spectacular increase in numbers, Mendall (1952) states that it was then breeding in at least 13 of Maine's 16 counties. Across the boundary in southeastern New Brunswick the Ring-neck now breeds commonly (Squires, 1952).

Coturnicops noveboracensis. Yellow Rail. — Discovered nesting in a marsh between Percé and Gaspé by Terrill (1943). Since changing residence to Sandy Beach in 1947 I have heard from two to four birds calling each spring in the marsh at the base of the little peninsula.

Charadrius vociferus. Killdeer. — One feeding with semi-palmated sandpipers on beach of Fox River, August 19, 1946, probably a migrant. That it may yet be found breeding in Gaspé is promised by the following records: two instances of breeding in northern New Brunswick (Squires, 1952); in southern Labrador Townsend (1917) saw a skin taken near Eskimo Point; and Lewis (1927) observed a bird, May 24, 1925, on Anticosti. Dionne saw one there in 1913, cited by Lewis (1924).

Capella delicata. Wilson's Snipe. — Breeds about Gaspé Bay; heard "singing" annually above the Sandy Beach marsh. In Autumn several have died after striking obstacles.

Heard migrating southward over Lake Ste. Anne at dawn September, 12-14, 1951. A few on the ground there September 13, 1951, and September 4-8, 1952.

Aegolius acadicus. Saw-whet Owl. — Remains found in wood road near Cape Gaspé, July 1937, possibly eaten by Barred Owl known to have occupied that locality; first Forillon record. Other remains have twice been found in the York Valley. During nearly 3000 twilight and nocturnal hours of field work from early June till November since 1935, I have not seen nor heard the call of a single Saw-whet Owl in northeastern Gaspé. That it may be more numerous in western Gaspé is suggested by Phillips' experience along the Cascapedia River — a pair seen and others heard, August 22 — September 10, 1922 (Townsend, 1923a). Demille (1926) also heard one east of Tabletop Mountain October 4, 1923.

Sphyrapicus varius. Yellow-bellied Sapsucker. — One seen 40 miles inland beside York River August 31, 1946. Rare in eastern Gaspé compared with status on northwest coast where Demille (1926) found it common.

Toxostoma rufum. Brown Thrasher. — A stray male sang at dawn June 21, 1948, near Sandy Beach. Escaping observation in the brush, it was neither seen nor heard later.

Sialia sialis. Bluebird. — One singing at Sandy Beach, June 21, 1948. Three immature birds seen August 12, 1948, on stump-land 10 miles south of Ste. Anne-des-Monts, and an adult male next day 6 miles nearer town. In late September, 1950, four young spent several days at the home of Mrs. Sidney Annett near the north shore of Gaspé Bay.

Parula americana pusilla. Parula Warbler. — Male seen singing on one day only at forest margin a mile west of Sandy Beach, June 22, 1948 — second Gaspé record, Demille (1926) having seen one on the north-west branch of the Madeleine River. Known to breed in northern New Brunswick (Bond, 1926), this species will probably be found nesting in southern Gaspé. There is one old record for Anticosti (Brewster, 1883).

Wilsonia canadensis. Canada Warbler. — Rare in north-eastern Gaspé. Not until 1949, my tenth season in this region, did I hear the unmistakable song of Canada's namesake. From June 13-18 a male occupied young mixed growth near shore at Sandy Beach. Lack of a mate doubtless prevented this coastal migrant from breeding. None has been recorded in suitable territory about Gaspé Bay, and in its tributary valleys, or along the coast as far as Grande Etang on the peninsula's north shore. Townsend's (1923a) record of several at Ste. Anne-des-Monts and Marsouins in July 1922, together with Demille's (1926) observations on the north branch of the Madeleine River east of Tabletop Mountain suggest that spring migration proceeds from the southwest along the St. Lawrence shore and up the Madeleine Valley. This derives support from Demille's observations that near Mont Louis spring migrants of various species appear earlier than residents along the headwaters of the rivers; also with my records of westward fall migration at Ste. Anne-des-Monts and Cap Chat (Ball, 1952).

Dolichonyx oryzivorus. Boblink. — From June 20 to July 2, 1952, a male sang daily in a meadow at the base of the Sandy Beach Peninsula, and was seen on July 29 and on August 9. No female was discovered. This the first recorded north of Newport, where Demille saw a pair in 1924. In 1922 Anderson

learned that this species was fairly common in the fields of southern Gaspé (Townsend, 1923a). I heard one singing at Matapédia June 4, 1953.

Molothrus ater. Cowbird. — Adult male perched for a few moments on door-yard post, Sandy Beach, August 29, 1952. This is the third known Gaspé individual, Demille (1926) having recorded one near Chandler in 1924. and Townsend (1923a) an immature bird on the Forillon August 25, 1919. Two, perhaps all, were seen in late summer and hence may be regarded as wanderers. Nevertheless, Lewis (1924) saw a caged male caught on Anticosti in May 1922. In New Brunswick Chamberlain (1887) regarded it as a rare summer resident. Recently Squires (1952) recorded it as not uncommon as far north as Fredericton, and states that a male was taken at Bathurst by Cameron June 14, 1947.

Hesperiphona vespertina. Evening Grosbeak. — The great invasion of the eastern states during the winter of 1945-46 brought the first recorded examples of this species to dooryards about Gaspé Bay. Several residents observed small flocks feeding on fruit of mountain ash (*Sorbus americana*). All were said to have departed by April 30. Inquiry indicates no subsequent visits to the peninsula.

Poocetes gramineus. Vesper Sparrow. — First recorded in northeastern Gaspé in 1946. Townsend (1923a) had already found several in full song during July at Ste. Anne-des-Monts and Madeleine. Demille saw 10 at Mont Louis September 24, 1923, possibly migrants.

In New Brunswick I have heard males singing in June (5, June 13, 1948) along Route 17 between St. Leonard and Campbellton. Since Philipp and Bowdish (1917) recorded this species as common and breeding in northeastern New Brunswick (Tabusintac), and Bond (1926) found it nesting at Jacquet River near the southern shore of Chaleur Bay, it should be sought in southern Gaspé. Godfrey and Wilk (1948) called it a rather scarce summer resident at Lake St. John, Quebec.

In 1941 a fire destroyed some 300 square miles of forest about the headwaters of the York, St. John, and Bonaventure rivers. Change in wind subjected some areas to a second burning which consumed trees killed earlier, and removed practically all the leaf-

mold and humus from the forest floor. One such area in the eastern edge of the burn, 36 miles inland, in the York Valley, after washing by rains, presented only the white limy subsoil in October 1941. Upon my return in 1946 after the war, fireweeds (*Epilobium*), scattered mosses, a few tiny blueberry bushes (*Vaccinium*), and widely separated saplings of poplar (*Populus tremuloides*), and fire cherry (*Prunus pennsylvanica*) had gained a foothold.

The sole bird found here was new to my Gaspé list, a male Vesper Sparrow, first seen singing July 22, 1946. Another bird seen nearby was believed to have been a female. Since both remained through August, nesting probably occurred. A pair was again present in 1947. Of two males singing June 17, 1948, at least one secured a mate.

No evidence of this little colony has been obtained since 1949. The vegetation has increased both in extent and size, some of the poplars being 10 feet tall in 1951. Other species of plants, including red raspberries (*Rubus idaeus*), an umbellifer (*Cicuta*?), everlasting (*Gnaphalium*), and young firs and spruces have become established. There remains, however, much bare soil as well as areas still in the vegetational stage that characterized the entire hilltop in 1946.

An environmental change more likely to have disrupted the colony is an emergency air field gouged out of the area during 1948-50. This project apparently having "died aborning", the same process of revegetation may induce a return of vesper sparrows.

Following are additional notes on 22 species previously recorded:

Buteo lineatus. Red-shouldered Hawk. — Although I confidently recorded (1938) two immature birds on the Forillon August 17, 1936, I must reluctantly admit that I cannot now recall the tail and wing markings. Having recently had occasion to identify the skin of an immature bird of less than average size and originally labelled *platyperus*, many skins of these two species were compared. I was impressed with the possibility of confusion in several cases unless markings on primaries and rectrices were noted.

Having seen no other examples of *lineatus* among many hundreds of migrant Broad-winged and Red-tailed Hawks, and having found no published records north of southern New Brunswick, my 1938 Gaspé record had best be regarded as hypothetical.

Coccyzus erythrophthalmus. Black-billed Cuckoo. — One called several times, 4:20-4:22 A.M., July 19, 1948, at Sandy Beach; second Gaspé record (Ball, 1943).

Bubo virginianus. Great Horned Owl. — The owl most often heard; restricted chiefly to the less disturbed forests throughout the peninsula.

Surnia ulula caparoch. Hawk Owl. — June 28, 1949, two fledglings, able to fly, perched on dead stumps in the 1941 burn. Uttered high, rising, hoarse but shrill calls suggestive of adult Red-tailed Hawk, but briefer. Studied and sketched in the rain. Second eastern Gaspé record and first of breeding. Demille (1926) reported a pair seen south of Mont Louis Lake, February 17, 1924.

Strix varia. Barred Owl. — Uncommon. Two called repeatedly at York Lake, 9:15 P.M., July 14, 1949. Second eastern Gaspé record. Demille saw one March 15, 1924, in the valley east of Tabletop.

Asio wilsonianus. Long-eared Owl. — We now have records of at least three individuals taken or seen about Gaspé Bay, all between August 7 and September 17, and all in open country bordered by forest (Ball, 1938, 1943). At Sandy Beach, August 13, 1951, in midafternoon, one perched for five minutes in a popular sapling in the burn, exchanging intent scrutiny with me. At dawn on the following three mornings it hunted near by over a hay field. Again heard calling September 24, 1951. The following year, on September 16 and 17, possibly the same owl or one of its kin, also hunted at dawn over a neighboring field.

Chordeiles minor. Nighthawk. — More numerous than earlier observation had implied. For example, on the evening of July 22, 1946, 20 individuals were flushed from the gravel road between York Lake and the mouth of York River (some 50 miles). Most of them were in the "burns," or cuttings. Two pairs nested annually on the Sandy Beach plateau (about 1 square mile). This density apparently prevails over the burns of 1921, 1935, and 1941, as well as in pasturelands along the coasts and rivers. Migration occurs in late August. Like nocturnal migrants (Ball, 1952) nighthawks diurnally descend the York River valley. On August 21, 1946, eight birds "Hawked" to and fro across the high road at Madeleine Fork, 31 miles inland.

The fact that only a single nighthawk was flushed from the road on the evening of the same day led to the belief that most of the population had migrated on this day. Again, in 1951, movement down the York occurred on almost the same date — August 20. Forty nighthawks had reached the upper settlements at 5:00 P.M., and hunted insects over the meadows for 50 minutes before continuing down-valley. None was seen after this date.

Apus pelagica. Chimney Swift. — Proves to be generally distributed through coastal villages where it nests in chimneys. Not uncommon inland near lakes and rivers in burns and cuttings, where hollow-topped dead stumps are available. According to Mr. Charles Lindsay about 300 passed several successive nights during mid-August, 1946, in a large furnace chimney in Gaspé village. These were doubtless migrants or pre-migrants.

Contopus virens. Wood Pewee. — The second Gaspé individual was recorded August 1, 1949; sang many times and was closely observed. No sign of it before nor later. This species has twice been recorded in mid-June near the south coast of Chaleur Bay (Squires, 1952). Probably breeds rarely in southern Gaspé.

Hylocichla guttata faxonii. Hermit Thrush. — Probably the most abundant thrush, breeding preferably in the "burns." Many nests have been found beneath young conifers, from 1 to 4 feet in height, scattered among brakes and deciduous saplings. For population statistics see Ball, 1952.

Hylocichla ustulata swainsoni. Olive-backed Thrush. — Common, especially in coniferous forest margins, e.g., along lake shores, rivers, burned and cut-over areas. See under the last species.

Hylocichla minima bicknelli. Bicknell's Thrush. — Not uncommon below timberline in the higher Shickshock Mountains. Also nests on Mount St. Alban behind Grande Grève and Cap-des-Rosiers where mists from the Gulf of St. Lawrence add moisture to the dense forest. Not yet discovered inland below 2500-foot elevation. See reference under Hermit Thrush.

Vireo olivaceus. Red-eyed Vireo. — Common among the young deciduous trees in regenerating burns, and in cultivated areas.

Vireo philadelphicus. Philadelphia Vireo. — Following the decline in numbers noted in my 1943 paper, this species continues rare in northeastern Gaspé. One specimen was taken August 16, 1946.

Dendroica palmarum hypochrysea. Yellow Palm Warbler. — Taverner's sight record of one at Percé June 10, 1915, apparently still stands as the only observation within the breeding season in northeastern Gaspé (Taverner's diary, *in litt.* from W. E. Godfrey). Brown (1926) reported it nesting near north-western Gaspé, presumably along the Grand Metis River, June 1925. On the Forillon and about Gaspé Bay I have found it a rather common fall migrant, but have no records between June 3 and August 25. In northeastern New Brunswick, Philipp and Bowdish (1919) found it nesting commonly in suitable localities.

Seiurus a. aurocapillus. Ovenbird. — Not uncommon as a summer resident in the 1921 burn in the York River valley, and in other localities where deciduous trees predominate. **Seiurus noveboracensis.** Northern Waterthrush. — Common migrant coastwise, but not yet found nesting in northeastern Gaspé (Ball, 1938). Brown (1926) recorded a nesting colony in Matane County.

Oporornis philadelphia. Mourning Warbler. — Found nesting annually at Grande Grève since 1936. Not uncommon in the burns and cuttings in the river valleys of northeastern Gaspé. Song distribution: June 14, Percé; June 28 - July 5, York Valley; June 29 - July 4, July 20-24, Grande Grève and Cap-des-Rosiers. Migrant immature male entered Grande Grève from Cap-des-Rosiers August 26, 1939.

Geothlypis trichas brachydactyla. Northern Yellow-throat. — Since my 1938 report I have found this species breeding in suitable habitat throughout the cleared coastal lands. Inland one or more pairs occupy the bushy inlets of nearly all lakes and ponds, as well as stream borders within the burns.

Wilsonia p. pusilla. Wilson's Warbler. — Nests in habitat similar to the last, but is less common.

Spizella a. arborea. Tree Sparrow. — Only in 1940 and 1941 were observations continued through October. In the former the first birds were seen near Gaspé Bay in October 4; the next year five on October 3. By mid-month the numbers had increased to 100 per

day, and in 1941 were still common when observation ceased November 5.

Interestingly enough the sole September record of this species was made on the plateau of Mount Albert, over 3700 feet above sea level, on the 25th in 1949. Two birds were seen in company with several Horned Larks. The wishful thought that these were residents of this subalpine habitat rather than early migrants is dampened by the realization that, since Townsend's discovery of nesting Pipits and Northern Horned Larks here in 1922 (Townsend, 1923b), so many naturalists have visited Mount Albert and Tabletop in summer that any breeding Tree Sparrows must almost certainly have been detected.

Lewis (1924) hesitated to record it as nesting on Anticosti, though admitting the possibility. Furthermore, Newfoundland having recently been removed by Peters and Burleigh (1952) from the breeding range of this species, its known southern limit must be placed north of the St. Lawrence Gulf. On the southern coast of Labrador Townsend (1917) recorded it nesting at Old Romaine, July 9-14, 1915. Lewis (1923) reported two singing males July 14, 1922, on the mainland near Perroquet Island, Bradore.

Passerella iliaca. Fox Sparrow. — Records for Gaspé are as follows: Seven inland during fall migration and "occasional along the coast in August" (Demille, 1926); one seen at Percé July 14, 1915, others singing there through July and three pairs at Bonaventure Island, 1919 (Townsend, 1920). Bond, in a recent letter expresses his belief that, whereas on June 14, 1925, he found several on Bonaventure, they apparently no longer breed there. I have seen them only in fall migration, sometimes common on the Forillon, less so south of Gaspé Bay.

Among species not yet recorded in northeastern Gaspé the following may some day be added to the list:

Hylocichla fuscescens. Veery. — Since Townsend (1920) heard three singing July 5-6, 1919, at Cross Point in southwestern Gaspé none seems to have been recorded on the peninsula until June 3, 1953, when I heard one singing at Matapedia. In northern New Brunswick, however, it is a not uncommon summer resident (Squires, 1952, citing Bond). In southern Labrador Audubon (*Birds of America*, 3:27) reported young, July 20, 1833, and Brewster (1883) saw a pair July 21, 1881.

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THE FOOD OF SOME SMALL MAMMALS FROM THE GASPE PENINSULA, P.Q.¹

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THE ROLE of small mammals to the forest has not received just recognition. Many are insectivorous; they far outnumber birds as a possible predator of arthropods. Populations of several dozen to the acre are not unusual in northeastern United States and Canada. The subject of insect control by mice and shrews has been summarized by Hamilton and Cook (1940), and Hamilton

(1941). Studies by Balch (1936) and Morris (1942) indicate that these mammals occasionally feed largely on the pupa of the spruce sawfly. More recently, Bess, Spurr and Littlefield (1947) have pointed out the importance of small mammals in reducing the gypsy moth.

This report deals with stomach analyses of small mammals collected on the Gaspé Peninsula from June 23-July 2, 1953. A

1) Received for publication October 9, 1953.

few specimens taken at Dalhousie, N. B. are included in the report. All of the included specimens were taken in forested areas, from a few feet above sea-level to elevations of 1100 feet. After preparing the conventional skins, all bodies were preserved in 10% formalin. Notes were made at the site of capture regarding possible vegetative foods of the animals. Stomachs were removed from the fixed specimens, placed in water for several days, then placed in glass petri dishes and examined under the low power of a binocular microscope. Frequency of occurrence and a rough estimate of percentage by bulk were tabulated for all foods.

Sorex cinereus acadicus. Two specimens were collected in the Gaspesian National Park, near the base of Mt. Albert, at an elevation of 1000 feet. One stomach contained a flea,

Corrodopsylla curvata, spider remains and undetermined insects. The other had eaten several enchytraeids, a beetle larva and considerable vegetation.

Sorex fumeus umbrosus. Five smoky shrews taken in a cedar woods, five miles east of Dalhousie, N. B. only a few feet above sea level. Two contained only earthworms, another had eaten earthworms, a small caterpillar and a spider. The fourth contained earthworms and a lepidopterous larva while the fifth had eaten several small dipterous larvae and a carabid beetle. Animal matter occupied more than 70% of the food. Measurements, in millimeters of the five averaged: t.l. 125, t. 45.4, h.f. 13.4.

Sorex gaspensis. Two specimens (topotypes) taken in the Gaspesian National Park at 1000 feet elevation, were collected in habitat occupied by *Sorex cinereus acadicus*. One contained beetle remains (70%) and undetermined plant matter. The other had eaten vegetation and a spider, the latter amounting to 30% of the total volume.

Peromyscus maniculatus abietorum. Collections were made at Carleton, Perce and the Gaspesian National Park. The stomachs of six animals were examined. Like the shrews, deer mice glean the forest floor, eating quantities of insects. Five of those examined had eaten insects, while the other contained remnants of a centipede. Included among the insects are beetles, caterpillars, undetermined insects in quantity and a spider. Remains of an earthworm were recovered

from one stomach. Animal food accounted for 35% of the volume. Mast, fruits and undetermined plant remains constituted the remainder.

Clethrionomys gapperi gaspensis. An abundant species in the Gaspesian National Park. In four nights of limited trapping, we took 21 specimens. Stomach analysis of red-backed mice is difficult, since the food, mostly of vegetable origin, is finely triturated. All contained vegetation. In the areas trapped, small cuttings of cedar were common. The terminal twigs and small laterals were found in abundance among the recesses and cavities beneath logs and sizeable boulders where these mice were taken. It seems probable that the cuttings were the result of feeding by this species. Six specimens contained insect remains, principally small caterpillars. One stomach contained fragments of a beetle and an aphid. Measurements of eight adults average: t.l. 152, t. 42, h.f. 19.2.

Napaeozapus insignis gaspensis. The woodland jumping mouse is an omnivorous creature, subsisting on both animal and plant material. Of the four stomachs examined, all contained insects. These included small tabanid and lepidopterous larvae (including geometrids and noctuids) and beetle remains. Other animal matter includes a slug, undetermined flesh and mammal remains. Plant matter constituted less than a third of the volume in the stomachs.

Of the six species examined, totalling 40 specimens, all had eaten arthropods. *Clethrionomys* is less insectivorous than the others which were studied.

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PLANT RECORDS FROM COPPERMINE, MACKENZIE DISTRICT, N.W.T.^{1, 2}

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DURING the summer of 1951, Mr. W.I. Findlay of this Division, while conducting a biological survey in cooperation with the Division of Entomology and Canada Defence Research Board, made a collection of plants in the Coppermine area near the mouth of the Coppermine River on Coronation Gulf, on the arctic shores of Mackenzie District.

The bulk of the specimens were collected in the immediate vicinity of Coppermine (67°49'N, 115°10'W), but specimens were also obtained from the following nearby localities: Bloody Falls on the Coppermine River, 8 miles southwest of Coppermine (67°44'N, 115°23'W), at the mouth of the Nipartoktuak River, 10 miles east of Coppermine (67°49'N, 114°45'W) and an island in Coronation Gulf four miles northwest of Coppermine (67°53'N, 115°13'W). With the exception of the last locality which is in Franklin District, all the above localities are in Mackenzie District. A map of the area is shown in figure 1.

The list of plants collected does not seem to be complete for the area, for such widespread genera as *Poa*, *Juncus* and others which would well be expected there, are not included. The collection is, however, of particular interest from a plant distribution point of view, for a number of species find their eastern limit of range in the Coronation Gulf area while others find their eastern limit of range along the arctic coast in that area. Some of the species in this latter group are found again on the islands of the Canadian Eastern Arctic, while others find their northern limit in the east at Chesterfield Inlet, Eskimo Point or Churchill and in Ungava District, Quebec, but all are apparently absent from the arctic coast between Bathurst Inlet and Rae Isthmus.

Unless otherwise stated, the collections cited in the list below are from the immediate vicinity of Coppermine; the habitat is given when that is known, followed by the collector's number in *italics*. All the specimens collected by Findlay are preserved

in the Herbarium of the Botany and Plant Pathology Division, Department of Agriculture, Ottawa, Canada (DAO). Duplicate specimens have been distributed. For purposes of discussion a few specimens preserved in the Herbarium of the National Museum of Canada (CAN), have also been cited.

PREVIOUS COLLECTING IN THE AREA

A list of some 20 explorers and expeditions who have investigated or visited the arctic coast between Point Barrow, Alaska, and Bathurst Inlet, N.W.T., between the years 1821 and 1920, and who have made collections of plants, is given by Fritz Johansen in Volume 5 part C of the Report of the Canadian Arctic Expedition 1913-18, 1924. Some of these men collected in the Coppermine area. More recently A.M. Berry, A. Dutilly, and A.E. Porsild and perhaps others have made collections while passing through, but to the author's knowledge none of these collections is as extensive as the one reported upon here, nor were there as many duplicates available for exchange with other institutions.

Catalogue of Species

POLYPODIACEAE

DRYOPTERIS FRAGRANS (L.) Schott — forming dense clumps on damp rocky ledges, 227.

EQUISETACEAE

EQUISETUM ARVENSE L. — moist tundra, 260.

LYCOPODIACEAE

LYCOPodium SELAGO L. — dry rocky areas of tundra, 258.

GRAMINEAE

HIEROCHLOË ALPINA (Sw.) R. & S. — common on light soil on ledges by cliffs, 70, 89. Raup's map (Raup 1947) does not show any collections along the Mackenzie District coast between Cape Bathurst and Boothia Peninsula; he does, however, show a collection from Victoria Island, opposite Coppermine. The nearest collections on the mainland are apparently some 150 miles to the southwest around Great Bear Lake. It

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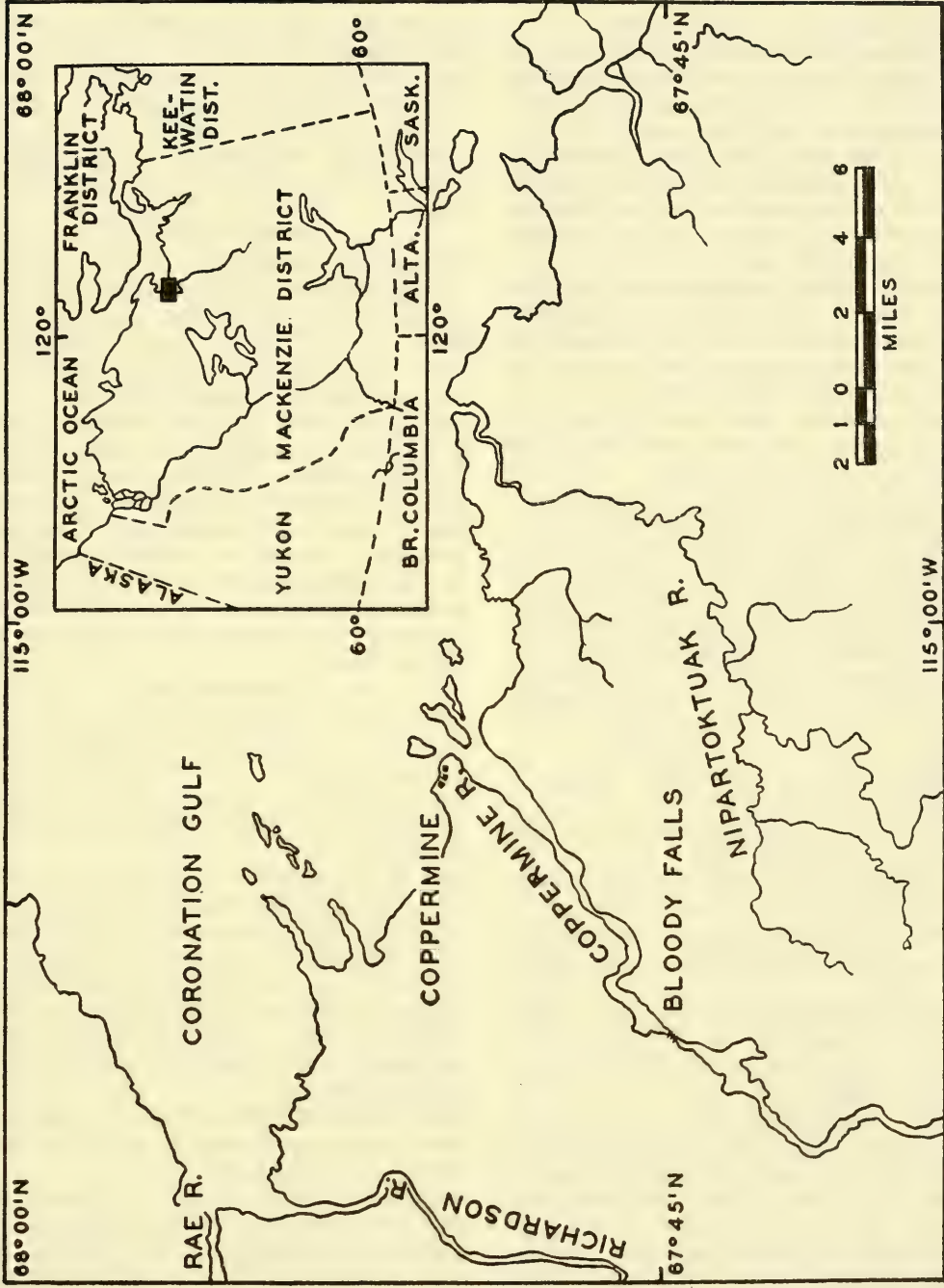


Fig. 1. Sketch map of Coppermine Area.

was not collected by the Canadian Arctic Expedition 1913-1918.
ALOPECURUS ALPINUS J.E. Sm. — wet fertile sod about settlement, common, 96.
CALAMAGROSTIS PURPURASCENS R. Br. — sandy soil at base of cliff, 217. The type of this species was collected “between Point

Lake and the Arctic Sea” [presumably along the Coppermine River]. Coppermine is apparently near the eastern limit of range of the species on the arctic coast. The range is then disjunct to Northern Baffin Island and Greenland.

DESCHAMPSIA BREVIFOLIA R. Br. — Bloody Falls: clay river bank, 206.

DUPONTIA FISHERI R. Br. var. PSILOSANTHA (Rupr.) Kurtz — wet boggy area near the river, 210, 215. The type of this species was collected on Melville Island.

COLPODIUM FULVUM (Trin.) Griseb. — Bloody Falls: mud flat along river, 207. This species was not collected by the Canadian Arctic Expedition 1913-18, but was certainly to be expected in the area.

BROMUS PUMPELLIANUS Scribn. var. ARCTICUS (Shear) A.E. Porsild — Bloody Falls: clay slide along river, 208. This is apparently from near the eastern limit of range of the species along the arctic coast.

ELYMUS ARENARIUS L. var. VILLOSUS E. Mey. — damp shore sands along beach, 244.

CYPERACEAE

ELEOCHARIS ACICULARIS (L.) R. & S. — rooted in soft mud in shallow water with *Ranunculus gmelinii*, 255B. Porsild (1943, p. 14) cites specimens from the Mackenzie River Delta and Great Bear Lake. This collection therefore represents an extension of range of some 100 miles to the northeast. Coppermine is probably near the eastern limit of range of the species along the arctic coast.

ERIOPHORUM SCHEUCHZERI Hoppe — wet sand near pool, 256.

ERIOPHORUM VAGINATUM L. — wet marshy tundra, 2, 30, 259.

ERIOPHORUM ANGUSTIFOLIUM Honckn. — common on swampy tundra, 54, 245.

CAREX SCIRPOIDEA Michx. var. SCIRPOIDEA — scattered stands on wet boggy tundra, 31.

CAREX BIGELOWII Torr. — edge of pools on tundra; common, 53.

CAREX AQUATILIS Wahl. — common about pond on tundra, 74.

CAREX RARIFLORA (Wahl.) J. E. Sm. — wet swampy tundra, 68. This collection is apparently from near the eastern limit of range of the species along the arctic coast.

CAREX VAGINATA Tausch — swampy, low lying tundra, 69. The eastern limit of range of this species along the arctic coast appears to be Coronation Gulf.

JUNCACEAE

LUZULA NIVALIS (Laest.) Beurl. — wet swampy tundra, 246, 261.

LILIACEAE

TOFIELDIA PUSILLA (Michx.) Pers. (*T. palustris* Huds.) — wet, fertile ground on

sod, 103. Coronation Gulf appears to be the eastern limit of range of this species along the arctic coast.

TOFIELDIA COCCINEA Richards. — moist sheltered areas, 232; Nipartoktuak River: rare in moist soddy spots on tundra, 189. The type of this species was collected by Richardson on the arctic shore of Mackenzie District.

ORCHIDACEAE

HABENARIA OBTUSATA (Pursh) Richards. — moist sheltered river shore, 181, 251.

Porsild (1943) reports this species as common in the Mackenzie region north to the limit of trees and occasional or rare a short distance beyond. Raup's map (Raup 1947) shows collections from the Mackenzie Delta, Great Bear Lake and Bathurst Inlet.

CORALLORHIZA TRIFIDA Chat. — damp soil on southern exposure, 165; Cemetery Island: much exposed sandy, tundra area, 119; previously known in northern Mackenzie District from Great Bear Lake and the Mackenzie River Delta. The known range of the species is thus extended some 100 miles to the northeast.

SALICACEAE

SALIX RETICULATA L. — prostrate on damp low ground often imbedded in moss, 26, 50, 51, 237.

SALIX ARCTICA Pallas (*S. anglorum* Cham.) — prostrate on flat wet tundra, 10, 11, 22, 23, 24, 25, 238.

SALIX GLAUCA L. — sheltered among rocky cliffs, 65, 66, 218; Cemetery Island: sandy bank bordering marshy area, 121, 122; Bloody Falls: common on high clay embankment, 150, 151. Raup's map (Raup 1947) shows the closest collections of this species to be at Great Bear Lake. These collections therefore represent a range extension of some 100 miles to the northeast.

SALIX RICHARDSONII Hook. — common on river slopes and on tundra, at foot of rocky slope, 4, 5, 8, 9, 27, 28.

SALIX PULCHRA Cham. — in wet, fertile soil about mission, and in sandy soil; not common in area, 37, 42, 43, 46, 212. The new growth shown in the mature specimens is villous-tomentous, hence these collections should probably be referred to var. *yukonensis* Schneider. Hulten (1941-50, p. 549) records Bernard Harbour as the eastern limit of *S. pulchra* along the arctic coast.

BETULACEAE

BETULA GLANDULOSA Michx. — sheltered rocky areas and south slopes and rocky

ledges by river, 34, 47, 64; Bloody Falls: southern clay hillside, 138. The eastern limit of this species along the arctic coast appears to be Coronation Gulf.

POLYGONACEAE

RUMEX ARCTICUS Trautv. — Bloody Falls: wet boggy area in low tundra, 146. The eastern limit of this species along the arctic coast appears to be Bathurst Inlet.

OXYRIA DIGYNA (L.) Hill — richer, often wet soil about settlement, 67.

POLYGONUM VIVIPARUM L. — damp grassy habitats, 171; Nipartoktuak River: thin soil on rocky ledges, 191.

CARYOPHYLLACEAE

CERASTIUM ALPINUM L. — rocky crevices and ledges on south exposed bluff and in sandy soil about settlement, 16, 63, 91, 130. **CERASTIUM BEERINGIANUM** Cham. & Schlecht. — Bloody Falls: sheltered clay soil on river bank, 204.

STELLARIA CILIATOSEPALA Trautv. — Nipartoktuak River: among rocks in moist more fertile soil, 195.

STELLARIA MONANTHA Hulten var. **MONANTHA** — flat soil about settlement, 111.

ARENARIA PEPOIDES L. — sandy shore of Coronation Gulf, 59, 115.

ARENARIA ROSSII R. Br. — rare in open sandy soil, 252.

ARENARIA RUBELLA (Wahlenb.) J.E. Sm. — in loose rubble on rocky, south exposed bluff, 131. Nipartoktuak River: a single specimen in soil in rock fissure, 185.

SILENE ACAULIS L. var. **EXSCAPA** (All.) DC. — forming dense mats on variously exposed open tundra and sand, 82; Bloody Falls: dry, often exposed tundra, 141.

LYCHNIS APETALA L. var. **ARCTICA** (Fries) Cody — moist heavy soil, 95, 155.

LYCHNIS TRIFLORA R. Br. — common in wet sand above beach and on rubble covered slope, 94, 177.

RANUNCULACEAE

RANUNCULUS PEDATIFIDUS J. E. Sm. var. **LEIOCARPUS** (Trautv.) Fern. — light soil on ledges and in crevices, 32, 85; Nipartoktuak River: soil in crevice along rocky bluff, 182.

RANUNCULUS PYGMAEUS Wahlenb. — damp wet soil near streamlet; rare in the area, 167.

RANUNCULUS GMELINII DC. var. **GMELINII** — rooted in soft mud in shallow water, 255A. According to the specimens cited by Benson (Amer. Midl. Nat. 40 (1): 207. 1948),

this species has not previously been collected on the arctic coast east of Cape Bathurst. Raup's map (Raup 1947), however, shows a specimen collected in the Coppermine area (sub nom *R. gmelinii* var. *purshii*). Coronation Gulf is apparently the eastern limit of this species along the arctic coast.

RANUNCULUS PALLASII Schlecht. — rare in shallow pond in marsh, 254. The only specimen cited by Macoun and Holm was from Camden Bay, Alaska. Hulten, Fl. Alaska and Yukon 4: 764. 1944, provides the following information on the distribution of this rare species: "America: besides from the above stations in Alaska, known only from the arctic shore of Mackenzie district, Churchill on the W. shore of Hudson Bay, E. shore of Hudson Bay about 61°N, and one station on southernmost Baffin Land" To this distribution the following localities can now be added: Eskimo Point and Chesterfield Inlet on the west coast of Hudson Bay, Fort George and Poste de Povognituk on the east coast of Hudson Bay, and Frobisher Bay on Baffin Island; specimens from these localities are preserved in the Divisional Herbarium (DAO). Also, in the Herbarium of the National Museum of Canada (CAN), there are specimens from 20 miles north of Lake River (54°23'N, 82°24'W) west shore of James Bay, and Cape Henrietta Maria in Ontario, and Mile 497 Hudson Bay Railway, about 13 miles south of Churchill, Manitoba. Coronation Gulf is apparently the eastern limit of range of this species along the arctic coast.

ANEMONE RICHARDSONII Hook. — level sandy river shore, 21. The eastern limit of range of this species along the arctic coast appears to be Bathurst Inlet, at the east end of Coronation Gulf.

ANEMONE PARVIFLORA Michx. — sandy sheltered flat along river, 6. The eastern limit of range of this species along the arctic coast appears to be Coronation Gulf. It is also known from the south shore of Victoria Island.

CALTHA PALUSTRIS L. var. **ARCTICA** (R. Br.) Huth. — shallow stagnant pond and in shallow slow-moving water, 45, 112. The type of *C. arctica* was collected on Melville Island.

PAPAVERACEAE

PAPAVER RADICATUM Rottb. — dry tundra areas among rocks, 88, 117.

CRUCIFERAE

DECURAINIA SOPHIOIDES (Fisher) O. E. Schultz — thin soil on rocky ledges and com-

mon in rich moist soil along ditches in the settlement, 39, 90, 97. These collections are from near the eastern limit of range of the species along the arctic coast. There is, however, a specimen in the Divisional Herbarium from Cambridge Bay, Victoria Island (69° 03'N, 104°50'W), some 300 miles to the north-east (*Sweetman & Smith* 29, July 21, 1950).
CARDAMINE PRATENSIS L. — damp marshy ground, 175.

CARDAMINE DIGITATA Richards. *C. richardsonii* Hulten (see *Rhod.* 54: 260. 1952). — sandy fertile soil near human abodes, 61; Bloody Falls: common in damp moss over clay, 135; this collection is from near the eastern limit of range of the species along the arctic coast.

DRABA NIVALIS L. — Nipartoktuak River: thin soil in rock fissure, 186.

DRABA FLADNIZENSIS Wulfen — cliffs near river, 44.

DRABA ALPINA L. — moist sandy soil; common in region, 55.

DRABA GLABELLA Pursh (*D. arabisans* Michx.) — common in thin soil on ledges of a southern cliff face, and in low wet more fertile soil in the settlement, 15A, 38.

DRABA CINEREA Adams — thin soil on ledges of a southern cliff face with *D. glabella*, 15B.

ARABIDOPSIS MOLLIS (Hook.) O.E. Schultz — in crevices in cliff face, 7, 33; the type of this species was collected by Richardson on the shores of the Arctic Sea between 107° and 130°.

ERYSIMUM INCONSPICUUM (S. Wats.) MacM. — thin soil on loose rocky slopes, 87; Bloody Falls; clay slides on river bank, 203. This collection is apparently from near the eastern limit of range of the species along the arctic coast.

ERYSIMUM PALLASII (Pursh) Fern. — Islands in Coronation Gulf off Coppermine: gravelly shingle along shore, 101.

SAXIFRAGACEAE

PARNASSIA KOTZEBUEI Cham. & Schlecht. — damp grassed over soil or sand, 107A, 172. Bloody Falls: damp, low ground, 142; Cemetery Island: damp sandy areas, sheltered by willows, 120. The eastern limit of range of this species along the arctic coast appears to be Coronation Gulf.

CHRYSOSPLENIUM TETRANDRUM (Lund) Th. Fries — on wet ground and ditch bottoms; common in restricted area, 62, 105.

SAXIFRAGA RIVULARIS L. forma **HYPERBOREA** (R. Br.) Hook. — 107B.

SAXIFRAGA CERNUA L. — damp soil in sheltered areas, 180; Nipartoktuak River: common on moist land, 187.

SAXIFRAGA CERNUA L. forma **RAMOSA** Gmel. — damp wet soil near government day school, 102.

SAXIFRAGA CAESPITOSA L. — Islands in Coronation Gulf off Coppermine: in rocky crevices or thin crust of soil with *Androsace chamaejasme* var. *lehmanniana*, 98B.

SAXIFRAGA NIVALIS L. — rocky land lightly covered with soil, 126; Nipartoktuak River: rocky ledges along river, 190; Islands in Coronation Gulf off Coppermine: exposed rocky shingle along shore, 100B.

SAXIFRAGA FOLIOLOSA R. Br. — sheltered damp soil, 247. Not collected by the Canadian Arctic Expedition 1913-18, but certainly to be expected in the Coppermine area. The type was collected on Melville Island.

SAXIFRAGA HIRCULUS L. — in low wet land and in moist fertile soil in settlement, 108, 164, 209.

SAXIFRAGA TRICUSPIDATA Rottb. — wet grassy habitats, 170; Nipartoktuak River: spreading over rocky surfaces, 194.

SAXIFRAGA AIZOIDES L. — bare clay areas on tundra, 257.

SAXIFRAGA OPPOSITIFOLIA L. — bare spots of clay on dry, northern-exposed tundra, 1.

ROSACEAE

RUBUS CHAMAEMORUS L. — damp fertile soil and in sphagnum bog, 109, 128. Raup's map (Raup 1947) shows an absence of specimens along the shore of Mackenzie District from approximately Cape Bathurst to King William Island; this collection helps fill in the picture of the northern limit of the species.

POTENTILLA FRUTICOSA L. — sheltered areas of tundra, 161, 213; Bloody Falls: southern exposed clay hillside, 133. Coronation Gulf appears to be the eastern limit of range of this species along the arctic coast.

POTENTILLA HOOKERIANA Lehm. — sandy dry areas and shallow soil on rock ledges, 12, 86; Nipartoktuak River: relatively common in clefts in rock on sheltered side of rock, 183.

DRYAS INTEGRIFOLIA M. Vahl — hummocks, hillocks in rocky and tundra areas, 36; Nipartoktuak River: common on exposed rocky tundra, 192; Bloody Falls: common on dry exposed hills and open tundra, 140.

LEGUMINOSAE

LUPINUS ARCTICUS Wats. — very common on higher more fertile tundra and in sandy areas, 19, 75. This collection is apparently from near the northeastern limit of range of the species.

ASTRAGALUS ABORIGINORUM Richards. — rocky slopes and among rubble at base of cliff, 41, 93; Islands in Coronation Gulf off Coppermine: rocky shingle along shore, 99A. These collections are from near the eastern limit of range of the species along the coast of Mackenzie District.

ASTRAGALUS ALPINUS L. — forming mats in sandy soil among grasses and in shallow soil covering rubble at base of cliff, 18, 71, 92, 163.

OXYTROPIS DEFLEXA (Pall.) DC. var. **FOLIOLOSA** (Hook.) Barneby — sandy soil, sheltered in gully; rare, 160. In northern Canada this species has only been collected from widely separated areas: Mackenzie River Delta, Coronation Gulf, southern Baffin Island and northern Quebec.

OXYTROPIS ARCTICA R. Br. — Sandy island in Coppermine River at Coppermine, 56; Islands in Coronation Gulf off Coppermine: exposed rocky shingle along shore, 100.

OXYTROPIS MAYDELLIANA Trautv. — open exposed tundra, 106, 211; Nipartoktuak River: dry exposed tundra, 188; Bloody Falls: few, on exposed tundra, 147.

HEDYSARUM ALPINUM L. var. **AMERICANUM** Michx. — slate and loose rubble on river bank, 216. Bloody Falls: common on clay banks sloping to river's edge, 145. The eastern limit of this species along the arctic coast appears to be Detention Harbour near the east end of Coronation Gulf (CAN), although there is a specimen from near the Hudson Bay Post at Bathurst Inlet to the southeast (W.I. Campbell 27), in the Divisional Herbarium.

HEDYSARUM MACKENZII Richards. — Bloody Falls: common on sheltered clay slope, 144; Islands in Coronation Gulf off Coppermine: rocky shingle along shore, 99B. These collections appear to be from near the eastern limit of the range of the species along the arctic coast; it is also known from Victoria Island, to the north.

HEDYSARUM MACKENZII Richards, forma **NIVEUM** Boivin — Bloody Falls: *Margy Webster, s.n.*, July 18-27, 1951 (DAO). This white flowered form has apparently not been reported from Mackenzie District although its presence was certainly to be expected.

LATHYRUS JAPONICUS Willd. var. **ALEUTICUS** (Greene) Fern. — common on sand beach, 179. Hooker cites a Richardson collection "to the shores of the Arctic Sea" that may possibly be referred to this taxon, but this specimen has not been seen; otherwise, it must be recorded as new to Mackenzie District. Other Mackenzie District collections seen are as follows: Arctic coast of Mackenzie at Tuktnayaktoq, 133°W. A.E. & R.T. *Porsild*, September 4, 1928 (CAN) and A.E. *Porsild*, July 25, 1935 (CAN); Coppermine River, Fort Hearne — Bloody Falls, A.M. *Berry* 1931 (CAN); west side of Bathurst Inlet, *Kelsall & McEwan* 198 & 239 (CAN.); carpets sandy areas near Hudson Bay Post, Bathurst Inlet, W.I. *Campbell* 39 (DAO). The latter two collections are apparently from the easternmost limit of range of the species along the arctic coast. This species was collected by the Canadian Arctic Expedition 1913-18, only at Shingle Point on the northern coast of Yukon, under the name *Lathyrus maritimus*.

EMPETRACEAE

EMPETRUM NIGRUM L. — dry exposed areas on hillocks and rocks, 35, 48.

ONAGRACEAE

EPILOBIUM LATIFOLIUM L. — common along grassy bank along drainage ditch at the settlement, 156; Bloody Falls: common among rocks in clay on river bank, 153, 202.

EPILOBIUM? PALUSTRE L. — wet flat tundra-like soil, 248; the specimens at hand do not compare well with others in the Divisional Herbarium from Canada, United States and Europe labelled *E. palustre* but because of the extreme variability in that taxon, seem best referred there.

PYROLACEAE

PYROLA GRANDIFLORA Radius — common in sandy soil sheltered by willows, 168; Bloody Falls: common in clay soil, sheltered by willows, 154.

PYROLA SECUNDA L. — rare in moist soil on exposed knoll, 250. Coronation Gulf is apparently the eastern limit of range of this species along the arctic coast. This collection is an extension of range of some 100 miles northeast from Great Bear Lake. There is also a collection from near the Hudson Bay Post at Bathurst Inlet (W. I. *Campbell* 21) in the Divisional Herbarium.

ERICACEAE

LEDUM PALUSTRE L. var. **DECUMBENS** Ait. — damp rocky areas, 228; Bloody Falls:

common on clay south-facing hillside, 139.
RHODODENDRON LAPPONICUM (L.) Wahlenb. — common on open tundra, 52.
CASSIOPE TETRAGONA (L.) D. Don — common on sunny slopes on rocky tundra, 49; Bloody Falls: shrubby heathy area on clay soil, 137.

ANDROMEDA POLIFOLIA L. — moist sod in settlement, and on the tundra, 104. This is apparently near the eastern limit of this species along the arctic coast.

ARCTOSTAPHYLOS ALPINA (L.) Spreng. — light soil in depressions on bare rock, 29.
ARCTOSTAPHYLOS RUBRA (Rehder & Wilson) Fern.; — dry sandy exposed areas, 3.

VACCINIUM VITIS-IDAEA L. var. *MINUS* Lodd. — rocky exposed soil 127. Raup's map (Raup 1947) shows this species occurring along the arctic coast only as far east as the vicinity of Cape Bathurst. This collection represents an extension of range of some 100 miles north from Great Bear Lake.
VACCINIUM ULIGINOSUM L. — common on tundra among rocks, 113, 169.

PRIMULACEAE

ANDROSACE CHAMAEJASME Host. var. *lehmanniana* (Sprengel) Boivin stat. n. *A. lehmanniana* Sprengel, Isis 1:1289. 1817 — in Coronation Gulf off Coppermine: rocky crevices or on thin crust of soil, 98A. Coronation Gulf appears to be the eastern limit of range of this species along the arctic coast.
ANDROSACE SEPTENTRIONALIS L. — light soil on cliff ledges with southern exposure and in moist fertile soil, 17, 60.

PRIMULA EGALIKSENSIS Wormsk. forma
VIOLACEA Fern. — sheltered banks along ditches; common in restricted area, 110, 118. Coronation Gulf is apparently the eastern limit of range of this species along the arctic coast.

PLUMBAGINACEAE

ARMERIA MARITIMA (Mill.) Willd. var. *SIBIRICA* (Turcz.) Lawr. — sheltered dry tundra, and in sandy soil, 77, 249; Nipartoktuak River: sheltered hummocks among rocks, 193.

GENTIANACEAE

GENTIANA DETONSA Rottb. — damp sand back from beach, 241. This collection is apparently from near the eastern limit of the species on the arctic coast.

GENTIANA PROPINQUA Richards. — damp sand back from beach, 240. This collection is apparently from near the eastern limit of the species along the arctic coast.

GENTIANA TENELLA Rottb. — damp sand back from beach, 242. Porsild (Nat. Mus. Can. Bull. 121:275. 1951) records this species from Bathurst Inlet. This, therefore, is the second record for Mackenzie District.

BORAGINACEAE

MERTENSIA MARITIMA (L.) S. F. Gray var. *TENELLA* Fries — prostrate in sand along ocean beach, 58, 176.

SCROPHULARIACEAE

CASTILLEJA PALLIDA (L.) Sprengel ssp. *MEXIAE* Pennell var. *ELEGANS* (Malte) Boivin — Bloody Falls: sheltered sandy or clay banks, 200. The eastern limit of range of this species along the arctic coast is apparently Coronation Gulf. There is also a specimen in the Divisional Herbarium from near the Hudson Bay Post. Bathurst Inlet (66°51'N 108°01'W) to the southeast (W. I. Campbell 38).

PEDICULARIS CAPITATA Adams — on sand dunes, often among willows, 56, 76.

PEDICULARIS SUDETICA Willd. — common in wet tundra areas, 80; Bloody Falls: common in wet mossy tundra, 152.

PEDICULARIS SUDETICA Willd. forma *ALBA* Cody — in wet boggy tundra growing among the typical form, 174.

PEDICULARIS LANATA Cham. & Schlecht. — common over tundra, in exposed locations, 13, 81.

PEDICULARIS LANGSDORFFII Fisch. — not common, on dry open sandy tundra, 78; Cemetery Island off Coppermine: sandy areas among light willow growth, 123.

PEDICULARIS LAPPONICA L. — in moist soil often sheltered by other growth and in sandy plateau areas near the river, 20, 79, 116; Bloody Falls: common on sandy sheltered southern hillside, 134. These collections are apparently from near the eastern limit of the species along the arctic coast.

PEDICULARIS LABRADORICA Wirsing — Bloody Falls: not common on south-facing hillside, 136. According to Raup's map (Raup 1947) the nearest records of this species are from Great Bear Lake, some 100 miles to the southwest. A further extension of range to the northeast is found in a collection from near the Hudson Bay Post at Bathurst Inlet, 66°51'N, 108°01'W (W. I. Campbell 35). These records are apparently from the eastern limit of range of the species along the arctic coast.

LENTIBULARIACEAE

PINGUICULA VULGARIS L. — wet boggy soil, 214. The eastern limit of range of this

species along the arctic coast is apparently Coronation Gulf. There is also a specimen collected near the Hudson Bay Post at Bathurst Inlet, 66°51'N, 108°01'W, to the south-east, in the Divisional Herbarium (W. I. Campbell 18).

PLANTAGINACEAE

PLANTAGO SEPTATA Morris — sandy beach, 178B; the eastern limit of range of this species appears to be Coronation Gulf.

COMPOSITAE

TARAXACUM PHYMATOCARPUM J. Vahl. — grassy soil in sheltered area, 124.

TARAXACUM LACERUM Greene — common on southern exposed rocks on cliffs, 132.

ASTER SIBIRICUS L. — common in sheltered areas on sandy bank, 158. The specimens at hand are single-headed, and are smaller and have entire to but slightly toothed leaves. They are considerably reduced from the plant known to the author from Great Slave Lake and Norman Wells and appear to be intermediate to the following:

ASTER SIBIRICUS L. var. *pygmaeus* (Lindley) stat. nov. *Aster pygmaeus* Lindley in Hooker Fl. Bor.-Am. 2: 6. 1834. Onno in Bibl. Bot. Heft 106: 19. 1932. — Bloody Falls: clay soil at river's edge, 143, 205. This appears to be a reduced local variety with single-flowered heads and narrow entire-margined leaves. The specimens cited above are an excellent match for photographs of Richardson's collections of *A. pygmaeus* inscribed "Arctic Sea Coast" and "Bear Lake and mouth of Coppermine River", which are preserved in the Gray Herbarium. Coronation Gulf appears to be the northeastern limit of *A. sibiricus*.

ERIGERON HUMILIS Grah., *E. unalaschensis* (DC.) Vierh., *E. uniflorus* of Macoun and Holm in part — common in sheltered sandy soil, 166. The eastern limit of range of this species along the arctic coast appears to be Coronation Gulf.

ERIGERON ERIOCEPHALUS J. Vahl — common on sandy beach, 178A.

ANTENNARIA ANGUSTATA Greene — dry rocky ledges on very thin soil, 184B, 230.

ANTENNARIA SUBCANESCENS Ostf. ex Malte (*A. alpina* sensu Macoun and Holm in Rept. Can. Arct. Exp. 5:21A. 1921.) — Nipartoktuak River: thin soil on rocky ledges, 184A. These collections are apparently from near the eastern limit of range of this species.

ACHILLEA MILLEFOLIUM L. ssp. *ATROTEGULA* Boivin — common on sandy slope by creek, 159; Bloody Falls: not common in sheltered gully near old stream, 149. These collections are apparently from near the eastern limit of range of the species along the arctic coast.

CHRYSANTHEMUM INTEGRIFOLIUM Richards. — open, usually damp tundra, 239; Nipartoktuak: sandy tundra, 198; Bloody Falls: general, but not common on sandy tundra, 199.

ARTEMISIA TILESII Ledeb.—Bloody Falls: common on clay sided slides or gulches, 201. According to Raup's map (Raup 1947), the eastern limit of range of this species along the arctic coast is Bathurst Inlet.

ARNICA ALPINA (L.) Olin var. *VAHLIANA* Boivin — rich soil at foot of cliff; southern exposure, 40.

ARNICA FRIGIDA Meyer — loose soil and rubble at base of cliff; not common, 129. This is apparently the northeastern limit of range of this species.

SENECIO CONGESTUS (R. Br.) D.C. — wet heavy soil in settlement; not widespread, 157. *SENECIO FRIGIDUS* (Richards.) Lessing — common on tundra, 173, 231. Nipartoktuak River: common on open tundra, in sandy soil, 196, 197. Specimens with both discoid and radiate heads were found in all the collections. The eastern limit of range of this taxon along the arctic coast appears to be Coronation Gulf.

SENECIO LUGENS Richards. — common in sandy sheltered cove, 162; Bloody Falls: common in dry soil in sheltered gullies, southern exposure, 148. According to Raup's map (Raup 1947), these collections are from the northeastern limit of range of the species.

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A PLANT COLLECTION FROM THE MEALY MOUNTAINS, LABRADOR, CANADA^{1, 2}

J. M. GILLET³

DURING THE SUMMER of 1950, while engaged in work under the auspices of the Defence Research Board, Department of National Defence, at Goose Bay near the western end of Lake Melville, Labrador, the writer, accompanied by Mr. W. I. Findlay, had the opportunity to fly by Norseman aircraft to an unnamed lake in the Mealy Mountains approximately seventy-five miles to the east.

In addition to insect material, eighty-five collections, including sixty-one species of vascular plants, were obtained during the three days from July 11 to July 14. Only the vascular plants are reported upon here.

In order to focus attention upon this neglected yet relatively easily accessible mountain range, and because of the paucity of material from the interior mountains of Labrador, it was considered worth while to list the species together with notes on habitat and relative abundance, and to briefly describe the region. No new entities are involved but the records of several alpine species may prove to be of interest to students of the Labrador flora.

Grateful acknowledgement is made to the Royal Canadian Air Force crew who flew us into the lake and, what is more important, flew us out again. Findlay's ingenuity enabled us to maintain a maximum of comfort with the minimum of camping equipment.

As far as the writer is aware the only collections from these mountains are by R.H. Wetmore who collected near the mouth of the English River in 1921. However, most of Wetmore's collections were made at Rigolet, Indian Harbour, and at the mouth of the Mulligan River on the north shore of Lake Melville. Wetmore's specimens are preserved in the National Herbarium, Ottawa.

The Mealy Mountain range extends in an approximately northeast-southwestern direction for about seventy-five miles. The western end is located twenty-five miles south of Goose Bay; the eastern end at the head of the North River which flows to the Atlantic just north of Sandwich Bay. Most of the range consists of a plateau approximately

1000 to 1500 feet above the Hamilton River valley. This plateau extends southwards for thirty to fifty miles to gradually merge with the innumerable hills and rugged terrain further south.

From the air the thousands of tiny ponds and lakes that pock-mark the surface in a northwest-southeastern direction indicate that this plateau has been heavily glaciated. Vegetation appears to be scant.

At the eastern end of the range, near the English River system, the Mealy Mountains reach an altitude in excess of 3000 feet. Kindle (1924) says:

"The Mealy Mountains, bordering the south shore of Lake Melville, constitute the most prominent topographic feature of the region. Seven peaks south of the eastern end of Lake Melville exceed 3000 feet, the highest rising 3800 feet A.T."

Slopes are gentle and contours of valleys also indicate the effect of glaciation. The northern slopes of the "Mealies" drop steeply to Lake Melville. Here again the region is studded with hundreds of small lakes, ponds, and streams.

Apparently no account of the geology of the Mealy Mountains has appeared. Kindle (1924) in describing the Lake Melville area, refers only briefly to the range. Davies (1843) who was among the first to describe the region says that the Mealy Mountains are reported to consist of mica slate but that he had no opportunity to verify the report. The country visited was precambrian. A few fragments of rock from the tops of the mountains were gathered. These fragments represent loose surface material and unfortunately not the bedrock.

The location of the lake visited has been tentatively established at 53° 49'N, 58° 38'W, estimated from course and speed of the aircraft from the last recognized landmark — St. John Island at the east end of Lake Melville. However, attempts to establish the identity of the lake with absolute certainty by means of aerial photographs in the National Air Photo Library have not been successful due probably to the height at which these photographs were taken, possible seasonal changes in water-level, and insufficient travel and observation on the ground. Read-

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2) Received for publication December 7, 1953.

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View of portion of lake from slopes, looking east.



Terrain from a small ridge near the camp-site.

ings obtained from the aircraft altimeter, indicated the lake level to be 1700 feet, while the height of some of the surrounding hills approximated 3000 feet ascertained by flying level with their summits.

The lake, situated in a rough cone of hills and mountains, is about a mile and a half long and a quarter mile wide. The shoreline consists of a band of igneous boulders perhaps ten feet wide, with alpine tundra beyond.

A marsh extends along the southeastern side of the lake and is fed by two small streams. The sparsely scattered trees are restricted to sheltered gullies and to the lee of hills. Larch is dominant with black spruce, balsam, alder, and dwarf birch less frequent. Slopes of the surroundings hills bear low larch-spruce forest that within a few hundred feet merge with a band of dwarf birch and alder. The birch-alder association ends abruptly a few hundred feet from the summits of the hills, apparently at the point where wind velocity and exposure becomes excessive.

Near the camp-site, established on the north shore, a swiftly flowing stream, perhaps 20 feet wide, empties into the lake and drains two small pools a few hundred yards to the north. The density and height of vegetation increases along its banks. The pools themselves derive their water from a large snowfield located near the western end of one of them. This snowfield had appreciably melted before we were flown out.

Early mornings were clear but by ten o'clock rain or dense mist prevailed almost continuously adding considerably to difficulties in maintaining camp.

Game was particularly abundant in the area. A herd of caribou, one black bear, and many water fowl were seen. Several small pools in the vicinity teemed with trout.

At the level of our camp many species occurred that were common to the Goose Bay flora. Among these were: *Larix laricina*, *Picea mariana*, *Abies balsamea*, *Dryopteris disjuncta*, *D. spinulosa*, *Eriophorum angustifolium*, *Clintonia borealis*, *Maianthemum canadense*, *Betula glandulosa*, *Geocaulon lividum*, *Coptis groenlandica*, *Amelanchier bartramiana* (here considerably dwarfed), *Rubus chamaemorus*, *Empetrum nigrum*, *Cornus canadensis*, *Ledum groenlandicum*, *Kalmia polifolia*, *Vaccinium vitis-idaea* var. *minus*, *Trientalis borealis*, *Viburnum edule* and *Solidago macrophylla*. A few species were new at this altitude: *Lycopodium alpinum*, *L. annotinum* var. *pungens*, *L. selago*, *Tofieldia pusilla*, *Sibbaldia procumbens*, *Phyllodoce caerulea*, *Pedicularis groenlandica*, *Pedicularis labradorica* and *Pinguicula vulgaris*.

In the list that follows, the numbers cited are those of the writer. A complete set of the specimens is preserved in the Herbarium of the Department of Agriculture, Ottawa.

CATALOGUE OF SPECIES

Equisetum sylvaticum L. var. *multiramosum* (Fern.) Wherry — Common on relatively dry soil under dwarf *Picea mariana* and *Abies balsamea*. 5249.

Lycopodium alpinum L. — Common on fairly dry soil near the lake. 5314.

Lycopodium annotinum L. var. *pungens* (La Pylaie) Desv. — On relatively dry soil. 5315.

Lycopodium selago L. — Common on lower slopes and in ravines. 5295.

Dryopteris disjuncta (Rupr.) Morton — Abundant on alpine slopes under dwarf *Picea mariana* and *Abies balsamea*. 5274.

Dryopteris spinulosa (O.F. Muell.) Watt — Under *Alnus crispa* in a ravine. Common but everywhere immature. 5254.

Picea mariana (Mill.) BSP. — Black spruce while common, seldom attained a height of more than five feet in the exposed dry alpine meadows. 5312. No *Picea glauca* was observed in the region. A more diligent search might have revealed it.

Larix laricina (Du Roi) Koch — Definitely the dominant tree, attaining a height of 10 to 15 feet in sheltered places and forming dense stands on sheltered slopes, 5243.

Abies balsamea (L.) Mill. — Observed frequently but not collected.

Juniperus communis L. var. *depressa* Pursh — A specimen brought in from the head of the Kenemich River by Mr. I. A. McKay who had travelled as far as the Mealy Mountains in order to carry out geographical studies, is included here.

Hierochloë alpina (Sw.) R. & S. This sweet-scented grass, quite scarce, was restricted to altitudes of about 3000 feet. 5279.

Scirpus cespitosus L. var. *callosus* Bigel. — Abundant, forming its characteristic tufts along marshy borders of lakes and in wet alpine meadows. 5318.

Eriophorum angustifolium Honck. — Rather scattered; about ponds and marshes of alpine meadows. 5285, 5307.

Eriophorum spissum Fern. — This species was restricted to the upper alpine areas — at least, no plants were seen about the lake. The specimen was collected along the border of a pool high on a wind-swept plateau. 5286.

Carex bigelowii Torr. — Sedges were still immature but a few about the margin of a small pool were identifiable. 5298, 5311.

Carex rariflora (Wahl.) Sm. — Margin of a pool. 5309.

Carex? saxatilis L. — Margin of a pool. 5310.

Juncus trifidus L. — Forming extensive

stands on stony alpine tundra near the summits. 5302.

Luzula confusa Lindeb. — On rocky alpine slopes above the level of *Betula glandulosa*; scattered but common caribou grazing ground. 5293.

Tofieldia pusilla (Michx.) Pers. — Usually in small patches on drier sphagnum peat, occurring occasionally on the slopes of the lake to the summits of the lower surrounding hills. 5271.

Clintonia borealis (Ait.) Raf. — Occasional near the campsite. 5251.

Maianthemum canadense Desf. — Quite abundant in the shelter of a clump of spruce. 5246.

Salix ? *arctophila* Cockerell — Particularly abundant along a small stream flowing into the south side of the lake. Also rather common on the soft peaty border of the lake near the campsite. Considerable variability is shown by this species. 5263, 5264, 5290, 5291, 5297.

Salix argyrocarpa Anderss. — Forming dense thickets along the border of a brook that flowed into the lake. A prominent shrub in the area, but in more exposed habitats appearing dwarfed. 5278, 5303.

Salix herbacea L. — The most abundant willow in the area, usually growing in dense moss along the lake shore. 5276, 5282.

Salix uva-ursi Pursh — Alpine slopes. Common. 5258.

Alnus crispa (Ait.) Pursh — Abundant everywhere and comprising a large part of the vegetation on the lower slopes and in ravines. 5242.

Betula glandulosa Michx. — Mixed with *Alnus crispa* and forming dense thickets. 5244.

Geocaulon lividum (Richards.) Fern. — Occasional. 5245.

Arenaria groenlandica (Retz.) Spreng. — Restricted to windy exposed places of upper alpine slopes, in cracks and rock crevices. 5284.

Silene acaulis L. var. *exscapa* (All.) DC. — Seen only on peaks of the surrounding mountains at perhaps 2500 to 3000 feet. Rare even in such habitats. 5281.

Coptis groenlandica (Oeder) Fern. — Common on tundra. 5253.

Amelanchier bartramiana (Tausch) Roemer — A species that is also very common in the Goose Bay area. Here, however, the shrubs seldom reach three feet in height. 5262.

Sibbaldia procumbens L. — At low altitudes on south-facing talus slopes. Very abundant and almost covering entire slopes. 5275.

Rubus acaulis Michx. — Very abundant along a stream bank. 5268.

Rubus chamaemorus L. — Common everywhere. 5250.

Empetrum nigrum L. — Abundant on dry hummocks in somewhat boggy places. 5313.

Viola conspersa Reichenb. — Along with *V. cucullata*, very abundant in a rich valley between steep hills and along the margin of a brook that coursed through the valley. 5269.

Viola cucullata Ait. — Ravine, in moist places under shrubs. 5289.

Epilobium anagallidifolium Lam. — Only one specimen found, along the shore of a small lake. Very rare, but probably its rarity only apparent, since the season was not sufficiently advanced. 5305.

Cornus canadensis L. — Quite common under dwarf *Picea mariana* and *Alnus crispa*. 5248.

Ledum groenlandicum Oeder — Rather common on mountain sides, occurring mixed with *Betula glandulosa* and *Picea mariana*. 5256; bearing the rust *Chrysomyxa ledicola* (Peck) Lagerh. 5255.

Rhododendron lapponicum (L.) Wahlenb. — Common on rocky slopes above the level of *Betula glandulosa*. This plant was collected in fruit. 5294.

Loiseleuria procumbens (L.) Desv. — Common on open slopes at altitudes above the *Betula glandulosa*. 5299.

Kalmia polifolia Wang. — Very abundant on lower slopes and in marshes and meadows. 5273.

Phyllodoce caerulea (L.) Bab. — Almost the dominant ground cover about the camp area and in full bloom on arrival. Before our departure, however, the corollas were quickly dropping. 5277.

Andromeda glaucophylla Link — Common on usually wet level places and associated with *Scirpus cespitosus* var. *callosus* and scattered *Ledum groenlandicum*. 5280.

Cassiope hypnoides (L.) D. Don — Extremely abundant on sheltered north-facing talus slopes above the lake. On one such slope the plants formed a continuous mat nearly 100 feet long that excluded all other vegetation. 5260.

Arctostaphylos alpina (L.) Spreng. — Abundant on rocky slopes above the birch level. 5292, 5299.

Vaccinium uliginosum L. var. *alpinum* Bigel. — Upper alpine slopes. 5288.
Vaccinium vitis-idaea L. var. *minus* Lodd. — Abundant on upper rocky alpine slopes but not found near the lake. This species, however, is abundant at Goose Bay. 5300.
Diapensia lapponica L. — Found only on barren upper alpine slopes above the shrub line. Abundant. The majority of plants were past flowering but a few sporadic individuals were still in bloom. 5283.
Trientalis borealis Raf. — Occasional at low altitudes under *Picea mariana*. 5247.
Veronica alpina L. — Rare. Only one plant seen, along the lake shore. 5257.
Castilleja septentrionalis Lindl. — Alpine slopes and on sides of cliffs. Occasional. 5304.
Pedicularis groenlandica Retz. — Lake shore and marshy area. Occasional, just commencing to flower. 5272.
Pedicularis labradorica Wissing. — Similar habitat to *P. groenlandica*. 5265.
Pinguicula vulgaris L. — Alpine meadows and wet tundra. 5301.

Lonicera villosa (Michx.) R. & J. var. *calvescens* (Fern. & Wieg.) Fern. — One of the most abundant shrubs of the lower slopes and ravines; particularly abundant in the vicinity of the camp. 5266.

Viburnum edule (Michx.) Raf. — A common shrub here as at Goose Bay. 5270.
Solidago macrophylla Pursh — Very abundant and about the lake and at low altitudes only. The material was immature and only a few more advanced plants could be collected. 5252.

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INSECTS COLLECTED FROM BIRDS' NESTS AT LONDON, ONTARIO¹

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SEVERAL AUTHORS have published studies of the insect fauna of birds' nests, one of the most recent contributors to this literature being Hicks (1953) who collected insects from 35 nests in Iowa and who compared his findings with the work of nineteen other authors. During the spring of the years 1951-1953 the present writer had occasion to study the nesting habits of birds in London, Ontario and, after the departure of the young birds from the nests, these nests were examined for the presence of insects. Each nest was removed from its mooring and placed in a paper bag. Later, in the laboratory, the nest was torn apart over a white porcelain tray and insects falling on the tray were collected. Adult insects were pinned and labelled or preserved in fluid while larvae were reared to the adult stage in jars containing part of the debris and nesting material from the nest, together with a layer of earth added to allow for pupation.

Adult insects were kindly identified by specialists in the classification of the various taxonomic groups. Beetles and flies were identified by taxonomists of the United States National Museum. Dr. R.H. Arnett identified Anthicidae and Cryptophagidae, Dr. R.E. Blackwelder identified Staphylinidae, Dr. L. M. Walkley identified Lathridiidae and Dr. C.W. Sabrosky identified Calliphoridae. Mr. G.P. Holland, Systematic Entomology, Department of Agriculture, Ottawa, identified the fleas.

Red-winged Blackbird (*Agelaius phoeniceus*)

During the period May 21 to June 18, 1952, fourteen nests were studied in a cat-tail swamp at the north-west corner of William and Huron Streets, the times of hatching of the eggs and of the departure of the young from the nests being noted. Eight of these nests yielded insect inhabitants.

Nest 1 (May 25):

- Coleoptera — Cryptophagidae — 5 adults
 — Staphylinidae (Aleocharinae)
 4 adults

1) Received for publication December 16, 1953.

— Lathridiidae: *Melanophthalma distinguenda* (Com.) — 1 adult

Nest 2 (May 25):

Coleoptera — Cryptophagidae — 4 adults

— Lathridiidae: *Melanophthalma distinguenda* (Com.) — 1 adult

Nest 3 (May 31):

Coleoptera — Cryptophagidae — 2 adults

— Staphylinidae: *Stenus* sp. — 1 adult

Nest 4 (June 2):

Coleoptera — Cryptophagidae — 1 adult

Nest 5 (June 1):

Diptera — Calliphoridae: *Protocalliphora* sp. near *sialia* S. and D.

On May 21 in this nest, which was woven to cat-tail stalks, there were two bald young birds and one egg which hatched the next day. The young birds left the nest on June 1. The fabric of the nest yielded 37 blowfly larvae, 30 of which were reared to the adult stage: June 13 (1♀), June 14 (5♀), June 15 (12♂, 11♀), June 17 (1♀).

Nest 6 (May 30):

Coleoptera — Anthicidae: *Anthicus* sp. — 2 adults

— Lathridiidae: *Melanophthalma* sp. — 1♂, 1♀

: *Melanophthalma*

(*Corticarina*) sp. — 1 adult

Nest 7 (June 9):

Diptera — Calliphoridae: *Protocalliphora* sp. near *sialia* S. and D.

A single larva was found in this nest and was reared to produce an adult female on June 18.

Nest 8 (May 31):

Coleoptera — Cryptophagidae — 2 adults

Robin (*Turdus migratorius*)

On June 7, 1951 a nest of a robin, built on the top of the wall of a dilapidated brick kiln in north-east London, contained two young birds which left the nest on June 16. Examination of the debris on the bottom of the nest disclosed myriads of wriggling larvae and 4♂♂ and 6♀♀ of the "European hen flea", *Ceratophyllus gallinae* (Schrank).

Phoebe (*Sayornis phoebe*)

A nest of a phoebe, built on an electrical insulator on the side of a building, contained five eggs on May 18, 1953. The young birds left the nest on June 15 when several larvae and one ♂ and one ♀ of the flea *Ceratophyllus gallinae* (Schrank) were found in the debris on the floor of the nest.

Catbird (*Dumetella carolinensis*)

A catbird nest in a bush of twin honeysuckle near the bank of the Thames River contained three eggs on May 23, 1953, a fourth being added on May 24 and a fifth on May 27. The birds hatched on June 7 and left the nest on June 17. Immediately after their departure two live flies of the genus *Culicoides* (Heleidae) were found on the floor of the nest and were engorged with blood. Dr. J. A. Downes, Veterinary and Medical Entomology Unit, Science Service, Ottawa, identified the specimens as being most probably *C. biguttatus* Coq., a species that has been found in nests of crows (Jellison and Philip, 1933).

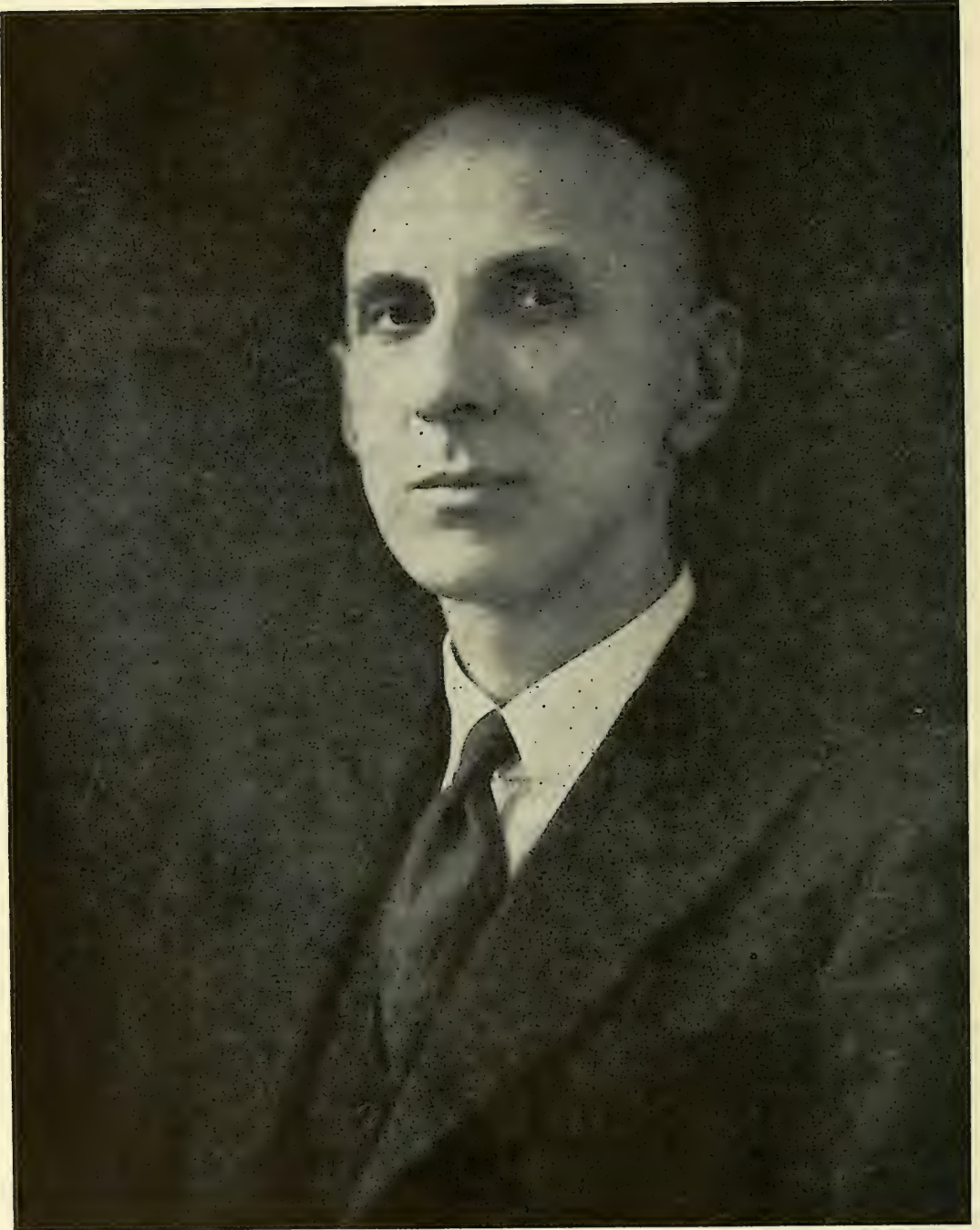
A second catbird nest, from which the birds had departed about two weeks previously, was found in a bush of twin honeysuckle in an abandoned brickyard in north-east London on August 3, 1953. In its fabric were several larvae which were reared to produce five adult flies on August 20. These proved to be *Minettia ordinaria* Mel. (family Lauxaniidae) as identified by Dr. Sabrosky.

Yellow Warbler (*Dendroica petechia*)

On June 24, 1953 Mr. W. Paton removed an abandoned nest of the yellow warbler from a willow bush on the bank of the Thames River. Embedded in the base of the nest and roofed over by a second floor of nesting material were two addled eggs of a cowbird (*Molothrus ater*). When the flooring of the nest was lifted, the two eggs were each found to contain a practically solid mass of writhing blowfly larvae which were allowed to complete their development on chunks of liver. From these larvae were reared 12 flies (July 6-1♀, July 7-4♂♂, 2♀♀, July 8-3♂♂, 2♀♀) which proved to be *Phormia regina* (Meigen) (Calliphoridae) as identified by keys in Hall (1948).

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Chas. L. Patch

CLYDE LOUIS PATCH

1887 - 1952

HOYES LLOYD

Rockcliffe Park, Ont.

C LYDE PATCH came to the Victoria Memorial Museum, later named the National Museum of Canada, on May 1st, 1913. He was born in Hiawatha, Kansas, June 30th, 1887, and grew up in northern Ohio and southern Michigan. After serving as an apprentice to a taxidermist and in commercial taxidermy for four years in Washington, D.C., he was employed in that capacity by the Biological Survey, United States Department of Agriculture, Washington, D.C., and by The American Museum of Natural History, New York.

He reversed a common procedure by seeking his fortune in Canada, bringing with him to his new work as Chief Taxidermist of the National Museum, great skill and artistic ability; for advanced taxidermy had by then ceased to be a mere ugly stuffing of creatures and had become an art, basically more closely related to sculpture than to any other.

Because of his great interest in herpetology, his title was changed to Chief Taxidermist and Herpetologist in 1918 and, in 1947, to Biologist.

He understood perfectly that our National Museum is a laboratory 3,000,000 square miles in extent and that, within this laboratory, living creatures, plants, fish, birds, reptiles, and other animals, including man himself, react upon each other in ever-changing patterns. To discover and record the happenings among living things in this great laboratory which is Canada, to preserve examples of its creatures, to show these artistically and naturally to all who come to learn about them are some of the aims of a National Museum. The building is but the heart of the research laboratory: the laboratory itself is Canada.

Patch did his best to advance Museum aims at every opportunity. If he tired of endless outside lecturing, he never showed it. A perennial member of the Museum lecture committee, he helped keep Museum lectures to the fore and spoke to many of these audiences himself.

In exhibits, there were heartbreaks: shortage of space, accommodation for Parlia-

ment after the 1916 fire, shortage of funds because of wars and depressions. Nevertheless the Museum advanced, some great habitat groups were completed, and many smaller ones now adorn the exhibition halls. The talented team of Patch and Johnson created exhibits that in quality are second to none — only the quantity lags. Tens of thousands see them yearly. When circumstances prevented the construction of many large habitat groups, he built models of these groups as he pictured them. They would be hard to improve upon — some day they will be enlarged to life size. He was dissatisfied with most beaver mounts, the beaver being a difficult subject, and he kept a live beaver to study its every action before embodying what he had learned in the large beaver habitat group now on exhibit. Schools have made steady use of the travelling bird and mammal exhibits ever since he prepared a special collection for lending to them.

When he came to the Museum, herpetology had been neglected. Today, this collection comprises hundreds of specimens from all parts of Canada. He collected many himself and received many others from correspondents whom he had interested in the subject. The illustrations for a book on the subject are prepared; the text is partly written. His gardening activities were brought into the Museum one summer by establishing an indoor botanical exhibit of wild plants and flowers, all labelled, and growing in almost natural surroundings.

He was a member of the Society of Ichthyologists and Herpetologists, and served as Councillor, Secretary, and First Vice-President of the Ottawa Field-Naturalists' Club. In addition, he acted as editor of Herpetology for *The Canadian Field-Naturalist* till his death.

Expeditions to Point Pelee, Frontenac County, and Algonquin Park, Ontario; Percé, Quebec; Vancouver Island and Queen Charlotte Islands, B.C., were his major field activities.

In Ottawa, the Gastronomic Club, an informal luncheon group of professional civil

servants with natural history tendencies, met for many years under his chairmanship and guidance. It was an instructive center for linking together allied interests in many of the services.

At the Y.M.C.A. Boys' Camp, Golden Lake, and at other camps, Mr. Patch was a welcome visitor and instructor who helped to place in growing minds a keen interest in nature and a love of it as the Great Naturalist has created it. W. A. Milks, long the Director of the Camp, describes him as one of nature's gentlemen and one about whom the boys flocked as he unravelled the mysteries of snake, frog, and salamander. It never took him long to dispel the fear of snakes and to have the boys making pets of the snakes instead of killing them. Continuing, Mr. Milks says that he made a great contribution to Canada in his chosen field and that life for many of the boys, now men, was richer because Clyde Patch opened their eyes to many wonders of nature.

Mr. Patch died at his Ottawa home, February 11, 1952, closing thirty-nine years' service for Canada and for Canada's National Museum.

A bibliography of his natural history articles, which does not include numerous newspapers items, is given below.

- 1917—*Reconnaissance in Barkley Sound, on the West Coast of Vancouver Island*. Summary report of the Geological Survey, Department of Mines, 1916, pp. 353-357.
- 1917—*Deer Mouse Devours Her Young*. The Ottawa Naturalist, Vol. XXXI, Nos. 5 and 6, p. 63.
- 1917—*My Bird Houses*. The Ottawa Naturalist, Vol. XXX, p. 155.
- 1917—*The Rough-winged Swallow near Ottawa*. The Ottawa Naturalist, Vol. XXXI, Nos. 3 and 4, p. 46.
- 1918—*A Crow Polygamist?* The Ottawa Naturalist, Vol. XXXII, No. 1, p. 6.
- 1918—*Unusual Nesting Material Used by Purple Martins*. The Ottawa Naturalist, Vol. XXXII, No. 2, p. 28.
- 1918—*The Economic Value of Batrachians and Reptiles*. The Ottawa Naturalist, Vol. XXXII, No. 2, pp. 29-30.
- 1918—*A List of Amphibians and Reptiles of the Ottawa, Ontario, District*. The Ottawa Naturalist, Vol. XXXII, No. 3, p. 53.
- 1918—*Another Record of the Rough-winged Swallow near Ottawa, Ontario*. The Ottawa Naturalist, Vol. XXXII, p. 77.
- 1919—*A Rattlesnake, Melano Garter Snakes and Other Reptiles from Point Pelee, Ontario*. The Canadian Field-Naturalist, Vol. XXXIII, pp. 60-61.
- 1922—*A Biological Reconnaissance on Graham Island of the Queen Charlotte Group*. The Canadian Field-Naturalist, Vol. XXXVI, No. 6, pp. 100-105; No. 7, pp. 133-136.
- 1923—*Report of the Ottawa Field-Naturalists' Club for the Year 1922*. The Canadian Field-Naturalist, Vol. XXXVII, pp. 159-160.
- 1923—*Report of the Wild Life Photographic Exhibition Committee*. The Canadian Field-Naturalist, Vol. XXXVII, No. 9, p. 170.
- 1923—*Birds of Ottawa*. Christmas Week, 1922-1923, The Canadian Field-Naturalist, Vol. XXXVII, pp. 18-19.
- 1924—*The Tiger Salamander at Ninette, Manitoba*. By Clyde L. Patch and D. A. Stewart. The Canadian Field-Naturalist, Vol. XXXVIII, No. 6, p. 81.
- 1925—*The Frog Eats the Bird*. The Canadian Field-Naturalist, Vol. XXXIX, No. 6, p. 150.
- 1925—*Graptomys Geographica in Canada*. Copeia, No. 149, Dec. 22, pp. 95-96.
- 1934—*Eumeces in Canada*. Copeia, No. 1, p. 50.
- 1934—*Die Arbeiten des Bibers*. Natur und Volk, Band 64, Heft. 8, August, pp. 307-315.
- 1939—*Northern Records of the Wood-frog*. Copeia, No. 4, p. 235.
- 1942—*A Backyard Beaver*. The Canadian Field-Naturalist, Vol. LVI, No. 3, p. 46.
- 1949—*Further Northern Records of the Wood-frog*. Copeia, No. 3, p. 233.

THE CANADIAN FIELD-NATURALIST AND ITS PREDECESSORS^{1, 2}

W. J. CODY and B. BOIVIN

*Division of Botany and Plant Pathology,
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IT is now 75 years since the Ottawa Field-Naturalists' Club, the offspring of another Ottawa society, put out its first scientific publication. In Transactions no. 1, page 7 we read in the Presidential Address: "Circulars were sent to the members of the Ottawa Literary and Scientific Society, calling a meeting of all those favourable to the formation of such a society [i.e. a society in this city devoted to the investigation of the natural history of the vicinity]. To the great satisfaction of those interested, fully forty gentlemen attended the meeting held on the 19th March, 1879. After a lengthy discussion as to the form the organization should take, the Ottawa Field-Naturalists' Club was born...".

From the very beginning the publication of a scientific journal was a major part of the activities of the Club and this emphasis may account for the continuity of publication for three-quarters of a century.

During the same period, the name of the Club has remained unchanged, but its publication has repeatedly seen changes in name and presentation. These modifications have coincided more or less with changes in scope and purpose of the Journal. These changes may be stated briefly as follows:

Ottawa Field-Naturalists' Club, Transactions, vol. 1-2, 1880-87, in 7 numbers; numbers 1-4 being paged separately and constitute vol. 1. Continued as:

The Ottawa Naturalist, vol. 1-32; 1887-1919; being vol. 3-34 of the Transactions of the Ottawa Field-Naturalists' Club. Continued as:

The Canadian Field-Naturalist, vol. 33-67, 1919-1953; vol. 33 being vol. 35 of the Transactions of the Ottawa Field-Naturalists' Club. The latter title was dropped after vol. 33 of The Canadian Field-Naturalist.

THE TRANSACTIONS

The minutes of the first year of the Club tell us about the genesis of the Transactions.

We read: "Moved by Mr. Billings, seconded by Mr. Harrington, 'That in the opinion of this Council, it is desirable that the papers read before the Club during the past season, including the Inaugural address and Secretary's report, which dealt with the original researches of members, or with the Natural History of the Ottawa district, should be printed as the Transactions of the Club for the year 1879-80.' Carried." (Quoted from Transactions no. 1, p. 11).

Seven numbers of these Transactions were published at the rate of one a year as follows:

OTTAWA FIELD-NATURALISTS' CLUB, TRANSACTIONS, vol. 1, nos. 1-4. These four issues of the Transactions are paged separately and were later considered to form vol. 1 although no mention of volume on the title pages or covers. No index. No volume title page.

Vol. 2, nos. 1-3. This volume comprises nos. 5, 6 and 7 of the Transactions, the numbering of issues being continued from the first volume. The paging is now continuous throughout the 3 issues. It seems fairly obvious that the first four numbers of the Transactions, 1880-83, were not originally intended to form a volume of their own. The treatment in volumes seems to have been an afterthought which first took shape around 1884, as Transactions no. 5 is the first number to carry the mention of volumes. The only mention of the change is in Transactions no. 6 (vol. 2, no. 2), p. 158 where one reads: "Transactions no. 5, Vol. II, No. 1, were published in due time and contained 152 pages." No index or volume title page was ever prepared for volume 2 of the Transactions.

THE OTTAWA NATURALIST

From the very beginning the scope of the Transactions was somewhat broader than the scope of the Club, for it included the publication of "the original researches of members" while for a long time the object of the Club remained "the study of the Natural History of this locality", namely Ottawa. This difference in scope probably played an important role in the next modification of the Club journal.

¹) Received for publication December 22, 1953.

²) Contribution No. 1339 from the Botany and Plant Pathology Division, Science Service, Department of Agriculture, Ottawa, Ontario, Canada.

The first number of the *Ottawa Naturalist* carries on page 9, the following editorial announcement:

"The *Ottawa Naturalist* is issued by the *Ottawa Field-Naturalists' Club* in continuation of its *Transactions* already published; the second volume of which was completed by the number for 1885-1886. For eight years the Club has earnestly carried on the field for which it was organized — "The study of the Natural History of this locality." Nor has it confined itself to this rich and extensive field. It has gradually extended its influence, and, by excursions, classes and lectures, has sought to foster a love for Natural History and a desire in all its members to investigate the marvellous realms of nature.

"After careful consideration of suggested changes in the method of carrying on the Club's work, it has been decided that its value, not only to members but to scientific observers in other places, will be greatly increased by the issue of a portion of its *Transactions* each month. This will ensure an earlier publication of the papers prepared for its soirees, which is especially desirable when new species are described, and will keep the members more fully informed as to the progress of its work."

This phenomenon of increase in scope is not peculiar to the *Ottawa Field-Naturalists' Club*. A similar case is that of the *Torrey Botanical Club*, a society responsible for the publication of a journal now international in scope, the *Bulletin of the Torrey Botanical Club*. The latter was started in 1870 as a four page monthly by W. H. Leggett with the object "to form a medium of communication for all those interested in the Flora of this vicinity" (i.e. New York City).

The change of title to *Ottawa Naturalist*, which took place in 1887, was a natural one, but no justification appears to have been given in the journal. We find it mentioned in *Ott. Nat.* 1:16 1887 as follows:

"The Council suggests that the journal be issued on the first day of each month under the title of "*The Ottawa Naturalist*."

With the change in title a new system of numbering of volumes and issues was inaugurated, but the old name, in a slightly modified form, and numbering system were carried as a subtitle throughout the 32 volumes of *The Ottawa Naturalist*. Thus the title page of the *Ott. Nat.* vol. 1 carries the following subtitle "*The Transactions of the Ottawa Field-Naturalists' Club, Vol. III*".

The policy of publishing monthly was not adhered to very long. In *Ott. Nat.* 3:6. 1889, we read: "The present number is the first Quarterly part of Vol. III of the *Ottawa Naturalist*." The following year the Journal reverted to twelve numbers, but was again reduced to eleven the year after. Such changes took place every few years. Joint numbers were also quite frequent. A resume of these variations is given in table 1.

THE CANADIAN FIELD-NATURALIST

Another important change in scope of the Journal soon took place. In *Ott. Nat.* 3:6. 1889, we read: "The scope of the publication has also been widened so as to include papers by members of the club upon the General Natural History of Canada, without being restricted as heretofore to this locality only."

This change in scope naturally called for a corresponding change in name, but the latter did not take place until the first number of volume 33 in 1919, when the *Ottawa Naturalist* became *The Canadian Field-Naturalist*. The numbering in volumes was continued from *The Ottawa Naturalist*. The alternate name, minus the apostrophe, "*Transactions of the Ottawa Field-Naturalists Club*", along with the alternate numbering of volumes, was carried as a subtitle in vol. 33 only. Starting with vol. 34, only one title and one volume numbering system remained.

As in the *Ottawa Naturalist*, the number of parts per volume has varied from time to time; combined issues are also quite frequent, but irregular. The number of parts and combined issues per volume is enumerated in table 1.

NUMBERING

Certain errors have crept into the numbering of volumes and numbers; these are enumerated in table 2. Special attention must be paid to the two numbers published in May 1924. Both are inscribed vol. 38, no. 6. The first one comprises pp. 81-100 and should be corrected to vol 38, no. 5. The second one is correctly inscribed "No. 6 (Special Number)"; it comprises pp. 101-120 and is almost completely devoted to an enumeration of the birds of Saskatchewan.

DATING

Currently the *Canadian Field-Naturalist* carries on the first page of each number the date of publication of the previous issue. This policy was inaugurated in 1943 with volume 57. Earlier volumes of the *Canadian Field-*

Table 1. NUMBER OF PARTS AND COMBINED NUMBERS PER VOLUME

Volume	Number of parts	Combined numbers
1 (3) ⁴	12	none
2 (4)	12	8 & 9, 10 & 11
3 (5)	4	none
4 (6)	12	none
5 (7), 6 (8)	11 each	none
7 (9)	12	11 & 12
8 (10)	10	none
9 (11), 10 (12), 11 (13)	12 each	none
12 (14)	12	7 & 8
13 (15)	12	none
14 (16)	12	1 & 2
15 (17) to 24 (26)	12 each	none
25 (27)	12	7 & 8
26 (28) to 31 (33)	12 each	3 & 4, 5 & 6 in each
32 (34)	9	none
33 (35)	6	none
34	9	none
35	7	none
(the index for volume 7 was published separately)		
36 and 37	9 each	none
38	10	none
39 to 55	9 each	none
56	9	8 & 9
57	9	2 & 3, 4 & 5, 7 & 8
58 to 66	6 each	none
67	4	none

4) The number in brackets represents the volume number of the Transactions and follows immediately the volume number of The Ottawa Naturalist.

Naturalist carry the date of publication of each number on the first page of the cover.

The Transactions indicate no exact date of publication, only the year, and even this is sometimes incorrect. Presumably each issue came out as soon as possible after the annual meeting which took place on or about the 15th of March. Presumably, Transactions 1 and 2 (vol. 1, nos. 1 & 2) came out on schedule. In the library of the National Museum of Canada the copy of Transactions 3 (vol. 1, no. 3) is stamped-dated October 4, 1882. The annual meeting for 1881-82 took place on March 21, 1882. Thus this number came out between April and September 1882, more probably in April as the National Museum does not seem to have acquired the copies of the Transactions until some time after publication.

Transactions 4 (vol. 1, no. 4) were published late as intimated in the Secretary's report for the following year: "Owing to a

series of unavoidable delays, the Transactions (No. 4) for 1882-83 were not published as early as would have been desirable...". In a lecture given on December 20, 1883, James Fletcher stated: "We have now published four parts of Transactions...". Presumably, Transactions 4 (vol. 1, no. 4) was published in the latter half of 1883.

Transactions 5 (vol. 2, no. 1) were apparently published in April 1884, for we read in the Secretary's report for the following year: "Transactions No. 5, Vol. II, No. 1, were published in due time...".

Transactions 6 (vol. 2, no. 2) is dated 1885 on the cover, but the title page is inscribed 1884. On the other hand, the Acting Secretary in his report for the following year given on March 16, 1886, stated: "...the issue of Transactions No. 6, (vol. II, No. 2) has, the Council regrets to state, only just been made." Therefore Transactions 6 probably came out in the first half of March 1886.

Table 2. MISNUMBERING OF VOLUMES AND ISSUES

(In bold face characters, the errors and corrections)

Year	Month	Numbering as issued	Corrected numbering
1894	December	vol. 8 (10) no. 8	vol. 8 (10) no. 9
1900	Apr.-May	vol. 14 (16) no. 1 ⁵	vol. 14 (16) no. 1 & 2
1904	March	vol. 18 (19) no. 12	vol. 17 (19) no. 12
1907	June	vol. 23 (23) no. 3	vol. 21 (23) no. 3
1907	July	vol. 23 (23) no. 4	vol. 21 (23) no. 4
1907	August	vol. 23 (23) no. 5	vol. 21 (23) no. 5
1907	September	vol. 24 (23) no. 6	vol. 21 (23) no. 6
1907	October	vol. 24 (23) no. 7	vol. 21 (23) no. 7
1924	May	vol. 38 no. 6	vol. 38 no. 5
1927	March	vol. 41 no. 4	vol. 41 no. 3
1950	July-Aug.	vol. 65 no. 4	vol. 64 no. 4

5) This is inscribed No. 1 on the cover, but No. 12 on page 7.

Table 3. OUTSIDE DATES OF PUBLICATION OF THE VARIOUS NUMBERS OF THE OTTAWA NATURALIST VOLUME I

Month	Number	Earliest Date	Latest Date
April	1	March 15	—
May	2	March	May 7
June	3	May 21	June 4
July	4	June 25	July 2
August	5	July 21	August 6
September	6	August 13	September 17
October	7	—	—
November	8	October 23	—
December	9	November 30	December 8
January	10	December 8	—
February	11	January 19	—
March	12	February 9	February 29

Transactions 7 (vol. 2, no. 3) were also published late. In the report of the Secretary for the following year, dated March 15, 1887, we read: "The Council has, however, to express its regret that the publication of this number was unavoidably delayed, so that it was only ready for distribution at the very close of the year." Whether this refers to the end of the calendar year or to the end of the Club year is not clear. But the latter is more likely as both the cover and the title page of Transactions 7 are inscribed 1887. Presumably Transactions 7 was published in the first half of March 1887.

The Ottawa Naturalist was originally scheduled to appear on the first day of each month, but wide discrepancies occur between

scheduled and actual dates of publication. The latter is printed on the first page of the cover of each number starting with volume 3, no. 1 through the volume 8, no. 10, and again from volume 15, no. 3, to volume 32, no. 9.

A set of the journal preserved at the National Museum of Canada shows dated library stamps on most numbers. A cursory check of these dated stamps against the dates of issue as given on page one of the cover of each number of the Ottawa Naturalist, revealed that in most cases the journal was received at the National Museum from one to three days, and occasionally up to two weeks, later than the claimed publication date. Discrepancies of more than two weeks

are either obvious errors in stamping or else apply to copies acquired at a later date.

The dates of receipt at the National Museum of the numbers of the Ottawa Naturalist not dated by the printer are given in table 4. When no date of receipt appears in this table, the copy at the National Museum was either undated, or else the date stamped appeared to be irrelevant to the date of publication. For example, all fascicles of volume 1 of the Ottawa Naturalist are uniformly stamp-dated March 21, 1888 or else unstamped, but these appear to have come out quite regularly on or about the first of the month as originally planned. This can be inferred by comparing the previous excursions and lectures or meetings reported upon in each number with the dates of forthcoming activities. For example the number for August 1887 contains a report of the July 21 excursion and the announcement of an August 6 excursion. See table 3 for these outside dates.

PAGING

Irregularities and duplication in the numbering of pages occur at three major points.

Each one of the four numbers of the first volume of the Transactions is paged separately, but volume 2 et sequ. are paged continuously.

No. 12 of volume 9 published in March 1896, was reprinted in February 1922 without covers or advertising. The paging is superficially identical in both cases, but actually the text of the reprint has been generally condensed in such a way as to gain up to 1¼ pages of the text in places.

The most troublesome item is the Flora Ottawaensis, a series of articles prepared by James Fletcher. The problems created by these papers are so complex that they will form the subject of a separate study³.

3) See: B. Boivin and W. J. Cody. Bibliographic Survey of James Fletcher's Flora Ottawaensis. In press. Scheduled to appear soon in the Canadian Field-Naturalist.

Table 4. DATES OF PUBLICATION OF THE OTTAWA NATURALIST
VOL. 2 AND VOLS. 9-14

Volume	Number	Received at National Museum	Date on cover
2 (4)	1	—	April, 1888
	2	June 1, 1888	May, 1888
	3	—	June, 1888
	4		July, 1888
	5	August 13, 1888	August, 1888
	6	October 6, 1888	September, 1888
	7	November 5, 1888	October, 1888
	8 & 9	January 18, 1889	Nov.-Dec., 1888
	10 & 11	March 15, 1889	Jan.-Feb., 1889
	12	April 25, 1889	March, 1889
9 (11)	1	April 24, 1895	April, 1895
	2	May 13 ----	May, 1895
	3	June 3, 1895	June, 1895
	4	July 9, 1895	July, 1895
	5	August 19, 1895	August, 1895
	6	September 16, 1895	September, 1895
	7	October 11, 1895	October, 1895
	8	November 11, 1895	November, 1895
	9	December 6, 1895	December, 1895
	10	January 8, 1896	January, 1896
	11	February 7, 1896	February, 1896
	12	March 6, 1896	March, 1896
10 (12)	1	April 23, 1896	April, 1896
	2	May 15, 1896	May, 1896
	3	June 23, 1896	June, 1896
	4	July 6, 1896	July, 1896
	5	September 16, 1896	August, 1896

Volume	Number	Received at National Museum	Date on cover
	6	October 20, 1896	September, 1896
	7	November 12, 1896	October, 1896
	8	December 22, 1896	November, 1896
	9	January 27, 1897	December, 1896
	10	March 11, 1897 ⁶	January, 1897
	11	March 15 1897	February, 1897
	12	May 14, 1897	March, 1897
11 (13)	1	June 3, 1897	April, 1897
	2	June 21, 1897	May, 1897
	3	July 17, 1897	June, 1897
	4	August 11, 1897	July, 1897
	5	October 29, 1897	August, 1897
	6	December 6, 1897	September, 1897
	7	December 14, 1897	October, 1897
	8	December 27, 18--	November, 1897
	9	January 24, 1898	December, 1897
	10	February 16, 1898	January, 1898
	11	March 5, 1898	February, 1898
12 (14)	12	April 4, 1898	March, 1898
	1	April 12, 1898	April, 1898
	2	May 7, 1898	May, 1898 ⁷
	3	June 15, 1898	June, 1898
	4	August 5, 1898	July, 1898
	5	August 26, 1898	August, 1898
	6	—	September, 1898
	7 & 8	November 17, 1898	Oct. & Nov., 1898
	9	December 27, 1898	December, 1898
	10	February 6, 1899	January, 1899
	11	March 4, 1899	February, 1899
	12	March 14, 1899	March, 1899
13 (15)	1	April 7, 1899	April, 1899
	2	—	May, 1899
	3	June 7, 1899	June, 1899
	4	July 10, 1899	July, 1899
	5	August 14, 1899	August, 1899
	6	September 19, 1899	September, 1899
	7	—	October, 1899
	8	November 4, 1899	November, 1899
	9	December 4, 1899	December, 1899
	10	—	January, 1900
	11	January 30, 1900	February, 1900
	12	March 28, 1900	March, 1900
14 (16)	1 & 2	—	April-May, 1900
	3	June 7, 1900	June 6, 1900

6) This date is probably correct as this issue contains the abstract of a lecture given as late as February 3, 1897.
 7) This number is inscribed April 1898 on the first page of text. This is obviously an error.

Because of the difficulties created by this duplication in paging, librarians are strongly urged to check carefully on the completeness and sequence of the set preserved in their library and be especially explicit in their instructions in sending their volumes to be bound. Covers of the various issues should not generally be discarded. They often carry

useful additional information, including dates of publication.

Of the library sets consulted of the Ottawa Naturalist, none was without missing pages, and only one had preserved the original covers with dates of publication and other useful information.

GLYCERIA MAXIMA ON THE MISSISSIPPI RIVER, ONTARIO, 1953^{1, 2}

R. L. GUTTERIDGE³

UNTIL recently English water-grass (*Glyceria maxima* (Hartm.) Holmb.), a native of northern Europe and Asia, was not known to be established in North America. The first collection was made at the marsh at Hamilton in 1940⁴, and subsequent investigations showed it to be established in Wentworth, Grey, Simcoe, Lennox & Addington, Frontenac, and Lanark counties, Ontario. Apparently present for many years in some of these counties, it is only in the rocky interior of Frontenac County that it has been utilized as a forage species to any considerable extent. Here its stands occupy large tracts of land which are flooded in the spring, and replace the wild grasses and sedges formerly harvested as "beaver hay". Based on Ontario specimens this species is mentioned for the first time in a North American Flora in the 150 edition of Gray's Manual under the name of *Glyceria spectabilis* Mert. & Koch.

In 1952 J. M. Gillett and W. M. Bowden discovered a stand of the plant on the Mississippi River at Pakenham, 30 miles west of Ottawa. To follow up this record and to see if it grew at other points on the river, observations were made in 1953 during a period in late May when the grass was in a vegetative condition and again in early September when it was mature. The banks of the river were scouted on foot or observed from a boat for a distance of 30 miles, from Mississippi Lake down to the juncture with the Ottawa River. More of the grass was found, and herbarium specimens, photographs, and plans of the individual stands were made and deposited at the Botany and Plant Pathology Division, Ottawa.

A total of 53 discrete stands occurred over a distance of 13 miles. Their positions are shown on the chart of the River (fig. 1); the upstream limit is 2 miles below Almonte, the downstream limit 2 miles above Galetta. None was found up tributaries or in the 12 miles above Almonte to Mississippi Lake. The river banks have also been

observed at accessible points above the Lake — Innisville, Ferguson Falls, Playfair, McDonald Corners, and Snow Road — and no stands were seen. At Snow Road there is a small patch of *G. maxima*, but this is in a bog at some distance from the river shore.

In contrast to the broad stands which spread out in beaver meadows in Frontenac County, all the patches in the lower Mississippi were along the shore and well within flood limits. The position of the stands and their occurrence in pure discrete colonies would indicate that spread is by vegetative means, rather than by seed (a very low percentage of "good seed" is set: 4% in 21 plants examined). The long, strong rhizomes which grow out a foot or two each year are very effective propagating organs, and chunks of the heavy rhizome-mats break off, probably by the action of ice in the spring, and drift away to lodge against the bank farther downstream. During the summer both free-floating and weakly attached masses were seen: the latter could easily be pulled free of the bank.

All of the stands were of the same clone, as indicated by similarities in habit of growth, panicle type, and colour of sheath. Averaging about 6 feet in height and having a broad, spreading panicle, this plant is easily distinguishable from the smaller, native *G. grandis*, its closest North American relative. Furthermore, *G. maxima* stems and leaves are harsh to the touch, and the Mississippi plants have red basal sheaths. These latter characteristics are helpful in identifying the plant in the vegetative condition.

The chart shows a concentration of stands at the upper limit near Almonte, where it is assumed that the plant got its start. The largest patch in this region is 180 feet long and 20 feet wide, indicating an establishment of many years duration as judged by the rate of growth of the rhizomes. The stands are smaller and become less frequent further down the river, but it is expected that as time goes by they will increase in size and number. The mouth of the Mississippi River is but 3 miles below the last stand, and within a few years the plant could well be-

1) Contribution No. 1343 from the Botany and Plant Pathology Division, Science Service, Department of Agriculture, Ottawa, Canada.

2) Received for publication December 22, 1953.

3) Survey Assistant in Taxonomy.

4) Dore, W. G. (1947). *Glyceria maxima* in Canada. Can. Field-Nat. 61:174.

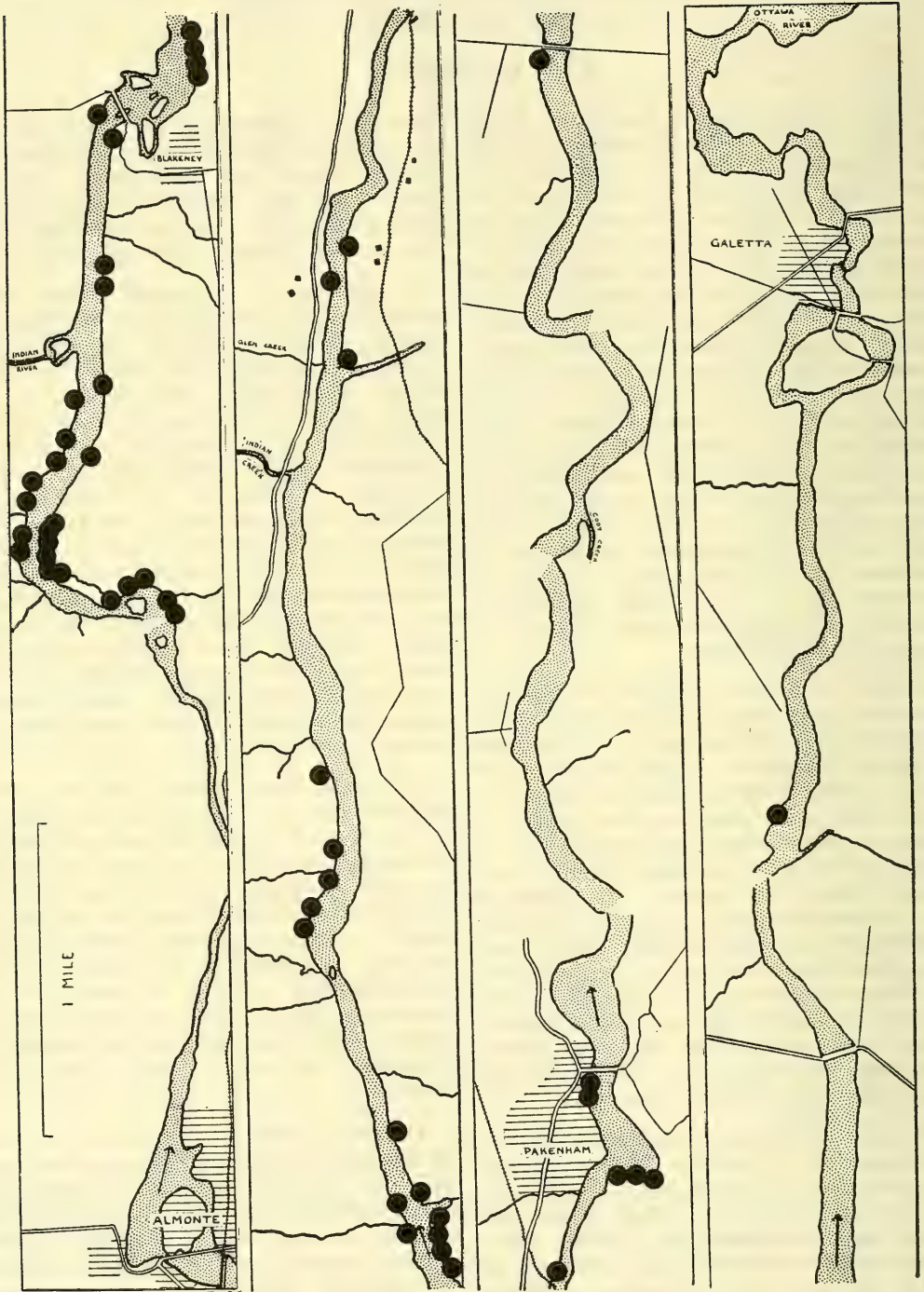


Fig. 1. Chart of the lower Mississippi River from Almonte (lower left) to its juncture with the Ottawa River below Galetta (upper right) showing location of stands of *Glyceria maxima* as observed in 1953.

come established in the Ottawa River, where it is not yet known.

The shoreline marsh where this plant grows consists principally of *Sparganium*, *Iris*, *Scirpus*, *Typha*, *Lythrum*, and *G. grandis*. (*Lythrum salicaria* is also a recently introduced species but spreads by seeds and forms almost continuous stands along the banks in contrast to the spotty growth of *G. maxima*). *G. maxima* develops almost pure stands and crowds out these plants. On the outside, the stands are usually fringed by *Pontederia*, *Sagittaria* and *Zizania*, and then by submerged waterweeds.

It has not been discovered how the original introduction occurred. The area has been intensively farmed in the vicinity of the upper patches, and perhaps a sod was carried in and planted there.

The clogging of waterways by *G. maxima* causes much concern in Britain⁵. There the

stems spread out into the water and form floating mats. In estuaries where there are daily fluctuations in the water level the masses break off and spread readily. The situation is similar in the Mississippi River except that the plants are more erect and there is less fluctuation in water level.

Cattle have grazed the stands at all accessible points. Consequently, it may prove here to be more valuable as a forage grass than in other parts of Ontario. Whether or not it is a desirable addition to the river flora is not now known. An increase in the size and numbers of stands over the next few years will determine this. Consequently, it seems important to record at this time the known extent of *G. maxima* in the Mississippi River.

5) Lambert, J. M. (1946). A note on the physiognomy of *Glyceria maxima* reedswamps in Norfolk. Trans. Norfolk & Norwich Nat. Soc. 16:246-259.

NOTES AND OBSERVATIONS

Purple Sandpiper in Manitoba. — Mr. L. T. S. Norris-Elye (Can. Field-Nat., 64(2):94) reported a sight record of a Purple Sandpiper, *Erolia maritima* (Brünnich), at the southern end of Lake Winnipeg.

Recently, while going over some of this museum's study skins, the writer found a skin labelled and catalogued as Pectoral Sandpiper. However, the collector's label (C. G. Harrold) is marked "Purple Sandpiper, Winnipeg, Manitoba." (no date) — this identification has been confirmed by Mr. Kenneth Racey of Vancouver as a female Purple Sandpiper.

It would seem then, that though the date is unfortunately lacking, a specimen of the Purple Sandpiper for Manitoba does exist.

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Winnipeg, Manitoba.

A LARK BUNTING IN KOOTENAY NATIONAL PARK, BRITISH COLUMBIA. —

While driving from Banff, Alberta, to Radium Hot Springs, B.C., with Mr. W. Winston Mair and Mr. R. Webb on May 26, 1953, a male

Lark Bunting *Calamospiza melanocorys* Stejneger was observed on the side of the highway near Dollyvarden Creek. The bird was associated with a group of Oregon Juncos *Junco oreganus* (Townsend) in a small clearing in the lodgepole pine forest on the Kootenay River flats. The bunting was collected and the specimen deposited in the National Museum of Canada, Ottawa. This appears to be the fourth record for the Province according to Munro and Cowan (1947) and the first for the Park according to Munro and Cowan (1944).

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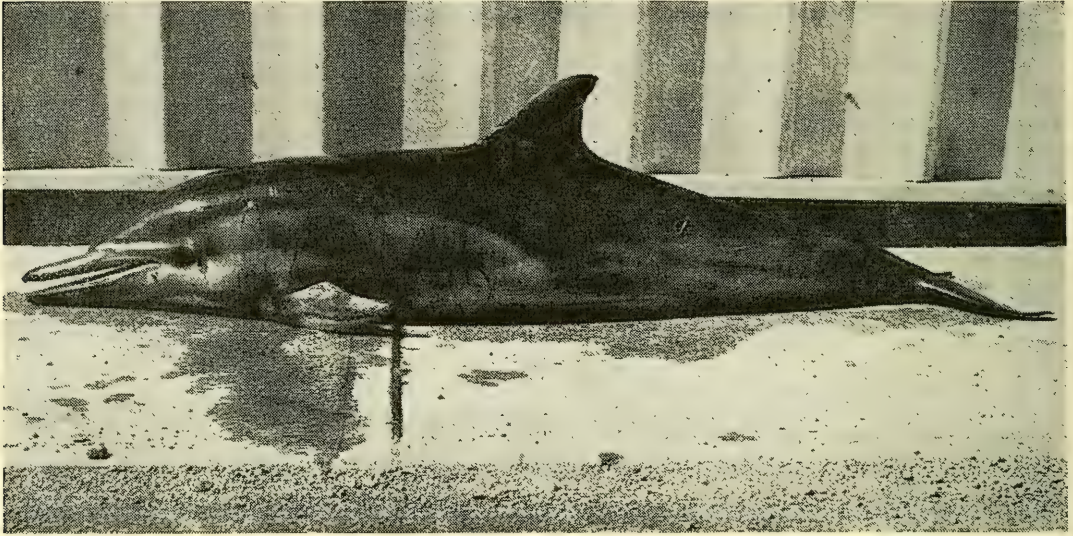
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Ottawa, Ontario.

A RECORD OF BAIRD'S DOLPHIN (*Delphinus bairdii* Dall) IN BRITISH COLUMBIA.

— On April 8, 1953, two youngsters discovered a Baird's dolphin *Delphinus bairdii* Dall, dead upon the beach at Victoria, B. C. The animal was in an excellent state of preservation, so recently dead that no apparent decomposition had set in. The specimen bore many superficial scars but had succumbed rather quickly, it seemed, to a mechanical injury which was apparent at the base of

the skull. The stomach was filled to capacity with partially digested herring.

Although suspected of occurring off shore, this species had been recorded previously in British Columbia only as unsubstantiated sight records. Details of this first specimen record, now stored at the Provincial Museum, may be of interest to Canadian mammalogists — data and a photograph are herewith presented. Measurements after Pike, *Journal of Mammalogy*, Vol. 34, No. 1, Table 1, page 101.



Baird's Dolphin, (*Delphinus bairdii* Dall) washed ashore at Victoria, B.C., April 8, 1953.

Sex — Adult male.

- | | | | |
|--|--------|---|-------------|
| 1. Total length from tip of snout to hind margin of flukes | 5'10½" | 16. Length along curve of lower border to tip of flipper | 8" |
| 2. Projection of lower jaw beyond tip of snout | ¼" | 17. Greatest width of flipper | 4" |
| 3. Tip of snout to blow-hole | 1' 1" | 18. Length of severed head (skull, flesh removed) from condyle to tip | 1' 2½" |
| 4. Tip of snout to angle of gape | 10¾" | 19. Length of flipper from head of humerus to tip | 11" approx. |
| 5. Tip of snout to centre of eye | 1' ½" | 20. Depth of body at dorsal fin | 1' 2" |
| 6. Tip of snout to tip of flipper | 2' 3½" | 21. Total spread of flukes | 1' 1" |
| 7. Hind margin of flukes to posterior emargination of dorsal fin | 3' 5" | 22. Width across blow-hole | ½" |
| 8. Width of flukes at insertion | 1' 2" | 23. Tip of snout to forehead groove | 5½" |
| 9. Hind margin of flukes to anus | 1' 8" | 24. Breadth of body at flippers (including flippers) | 1'10¾" |
| 10. Hind margin of flukes to umbilicus | 3' | 25. Breadth of body at blow-hole | 8½" |
| 11. Centre of reproductive aperture to centre of anus | 6½" | 26. Blubber thickness on flank in line with dorsal fin | ½" |
| 12. Height of dorsal fin | 6" | Total weight — 119 lbs. | |
| 13. Length of base of dorsal fin | 10" | Teeth — Upper jaw — 86 | |
| 14. Axilla to tip of flipper | 9¼" | Lower jaw — 86 | |
| 15. Tip to anterior end of lower border of flipper | 6" | | |

C. J. GUIGUET,
Provincial Museum,
VICTORIA, B.C.

PHALAROPES AT NIAGARA FALLS. — In my "Water Birds of the Niagara" (Can. Field-Nat. Vol. 59, No. 5: p. 165, 1945), the Red Phalarope is mentioned as having occurred at Niagara Falls, according to the 1935 to 1941 records of the Buffalo Ornithological Society in their mimeographed journal "The Prothonotary."

Subsequent to the writing of that article, both the Red Phalarope, *Phalaropus fulicarius*, and the Northern Phalarope, *Lobipes lobatus*, have occurred on the wide expanse of the river below Niagara Falls with a fair degree of regularity over a period of years.

On September 26, 1947, six Phalaropes were found swimming and feeding on the waters of the Lower Niagara near the Maid-of-the-Mist landing docks. Five of this group, keeping very close together during the period of observation, were undoubtedly referable to the Northern Phalarope, but one paler coloured bird, usually swimming somewhat apart, and not so closely observed, could have been a Red Phalarope; but was not conclusively identified as such.

The following day, September 27, a visit to the Maid-of-the-Mist docks between 3 p.m. and 4 p.m. E.D.S.T. revealed six Phalaropes in one group swimming and feeding in the more sheltered waters near the inner landing stage. When disturbed by the boats they broke up into two groups of three birds each, one party approaching to within a few feet of the dock side, and allowing such close scrutiny that no element of doubt was left regarding their identity as Northern Phalaropes. All six of these birds, when seen together, seemed to be remarkably uniform in plumage pattern, and although one or two were a little larger, and one at least at very close range was seen to have faint traces of a buffish colour on sides of neck, all had the typical slender black bills of the Northern Phalarope. There was no trace of the very different appearing bird seen on the previous day. The dark colouring of the backs, with warm buffy margins to the feathers, on all six birds observed on the 27th, would indicate that they were young of the year. Underparts were generally white, but a little mottling on some flanks was discernible at close range. All showed very distinct white wing bars while in flight.

At the Maid-of-the-Mist docks on October 4, and again on the 5, 1948, two Red Phalaropes were found swimming and feeding on

the quiet waters near the inner landing stage. On both days, they were observed at close range over considerable periods of time. One bird, larger than the other, and believed to be a young female, had a diffusion of buffy colour on the upper breast, an almost white head with a dusky mark back of the eye, and a well defined dark area from the top of the head to the base of the neck, which was reduced to a narrow line on the neck itself. The back had large patches of pale slaty-grey, and a few smaller areas of darker feathering with pale edgings. The bill was shortish, rather thickened at base, and in some lights showed faint traces of reddish-yellow near base, otherwise appearing dark to blackish. The other bird, seemingly smaller and probably a male, appeared to have an entirely dark or blackish bill, but of the same shape. In body colour, it was very pale, practically all white and pale slaty bluish-grey, with the exceptions of dusky markings at back of eye, and on head and neck.

Two days later, on October 7, in company with W. L. Putman of Vineland Station, a solitary Phalarope was seen swimming in the quiet waters near the Maid-of-the-Mist docks. It made several short flights while under observation, but remained within the immediate vicinity throughout the period of our stay, thus affording many excellent opportunities for close scrutiny. This bird, although without doubt a Red Phalarope, did not appear to be either one of the two seen together at this point on October 4 and 5. It was a large bird, and therefore presumably a female, but was greyer than the supposed female of the earlier observation, but not so generally pale as the smaller bird of the two seen together at that time.

In the year 1949, on September 29, three Phalaropes were seen well out on the river between the Maid-of-the-Mist docks and the Rainbow bridge. Two of these birds were light in colour and appeared to be larger than the other which was somewhat dark on the back, and had a smaller appearance. All three Phalaropes were examined through field glasses at some length, both while swimming and in flight, but the distance was too great for really definite specific determination. However, at the time, it seems reasonable to hazard a guess that the two lighter coloured birds were Red Phalaropes, and that the bird with the dark back was probably a Northern Phalarope.

The next day, September 30, two Phalaropes only were seen swimming and taking short flights in the same stretch of River below the Falls. The two birds on this second day appeared all grey and white, no dark markings on the back discernible, a circumstance which tended to strengthen the supposition that the two larger lighter coloured birds seen on both days were referable to the Red Phalarope.

Out beyond the Maid-of-the-Mist docks, swimming and feeding among the Gulls in choppy water, on September 26, 1950, a solitary Northern Phalarope was observed at moderately close range. This was a dark-backed bird with the strongly contrasting white wing bars noticeable when in flight, and could not have been other than the Northern species.

No Phalaropes of either species were found in the vicinity of the Falls in the year 1951; but on October 25, 1952 a Red Phalarope, in the complete grey winter plumage, afforded prolonged observation from the Maid-of-the-Mist dock side as it swam around in the inner bay, coming at times quite close to the dock side, and boat runways.

On September 12, 1953, earlier than all the preceding records, a Phalarope, not then observed closely, but almost undoubtedly a Northern, was seen in flight, swimming, and on one occasion walking on a solid mass of floatsam beyond the large rocks north of the Maid-of-the-Mist inlet. The next day, September 13th, a Northern Phalarope, a large darkish plumage bird, was observed swimming around near the Maid-of-the-Mist landing stages, and in the basin inlet, over a considerable period of time. At times this bird allowed an extremely close scrutiny by swimming to within a few feet of my position on the concrete rock. When it finally flew up, a second Phalarope previously unobserved, flushed from the immediate vicinity, and followed the larger bird toward the more open waters of the river beyond the outer landing stage. Both the larger female, for such it doubtless was, and the smaller, apparently male, bird, showed conspicuous white wing bars when they flew, the tapering white bars contrasting strongly with the dark areas of feathering on the back.

From the above recorded autumnal occurrences covering six years out of seven, and the considerable number of other records now extant for the general area, it would

appear that the distributional status of both the Red and the Northern Phalarope should be revised to indicate something more than just casual, or accidental occurrence in the region of the Lower Great Lakes. — R. W. SHEPPARD, Niagara Falls, Ontario.

A record of the white whale in the Bay of Fundy. — An adult female white whale (*Delphinapterus leucas* (Pallas)) was caught in a herring weir at Maces Bay, Charlotte County, New Brunswick, on June 12, 1952. It was killed by rifle bullets and towed to a wharf, where it was examined by the writers the next day. The following measurements were recorded:

Total length, tip of snout to notch	
of flukes	11'6"
Tip of snout to blowhole	1'1"
Tip of snout to angle of gape	6½"
Centre eye to centre ear	5½"
Width flukes at insertion	11"
Notch of flukes to anus	3'0"
Centre anus to reproductive aperture	4"
Tip flipper to anterior end lower border	1'6"
Greatest width flipper	10½"
Total spread flukes	2'6"
No. teeth projecting through gum:	
upper jaw-left	10
upper jaw-right	9
lower jaw-left	8
lower jaw-right	8

The specimen was a uniform milk-white in colour and thus a full grown adult. The uterus was enlarged and congested, and the mammary glands exuded milk when squeezed, showing that it had recently calved, although no calf was seen when it was caught. The stomach contained remains of gadcid fish, crabs, whelks, annelid worms and numerous nematodes of the genus *Anisakis*.

The white whale has been recorded from Cape Cod, Massachusetts, and Atlantic City, New Jersey (Anderson, R.M., 1946, Catalogue of Canadian Recent Mammals, Nat. Mus. Bull. 102, Ottawa). There appear to be no previous records for the province of New Brunswick, although the species is well known in the St. Lawrence estuary. Fishermen in the Bay of Fundy have reported sighting a white whale from time to time during the summer of 1953. The occurrence of this typically northern form is interesting in an area in which mean

water temperatures have been rising in recent years, and in which occurrences of normally more southern forms of marine life are increasing. The water temperatures in the Bay of Fundy however are still within the limits of temperature in which the white whale commonly occurs in the Gulf of St. Lawrence.

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Fisheries Research Board of Canada,
St. Andrew, N.B.*

The Cattle Egret at Sea off Newfoundland. — The Cattle Egret, *Bubulcus ibis* (Linnaeus), occurs in much of Africa, parts of southern Europe, and southern Asia. Its recent appearance in the western hemisphere has aroused a considerable amount of interest. Since Blake (1939, Auk, 56 (4): 470-471) recorded the taking of the first New World specimen on May 27, 1937, in British Guiana much has been learned about the bird in northeastern South America and its very recent spread into North America. Havereschmidt (1953, Audubon Magazine, 55 (5): 202-204, 236) sums up its known present status in South America: in British Guiana (where flocks are now known to have been present since about 1930); Dutch Guiana, Venezuela, and Colombia. Whether the first colonizers from the Old World crossed the ocean to South America under their own power or were taken there by man is a question that has not been satisfactorily answered and perhaps never will be.

The species has now spread to North America, presumably from South America. Drury (1953, Auk, 70 (3): 364-365) was first to record it on this continent, a male collected at Wayland, Mass., on April 23, 1952. However, Sprunt (1953, Audubon Magazine 55 (4): 178-180) gives a convincing sight record of one in Florida in 1948. Sprunt tells also of records in 1952 of two at Cape May, New Jersey; one near Chicago; late November records of single individuals near Cambridge and North Truro, Massachusetts; and some Florida occurrences. Most interesting of all, he records actual nesting at Lake Okeechobee, Florida, in 1953.

In the autumn of 1953, Leslie M. Tuck, Dominion Wildlife Officer, Canadian Wildlife Service, St. John's, Newfoundland, donated a

skin of the Cattle Egret to the National Museum of Canada. This specimen is of particular interest not only because it apparently represents the northernmost North American occurrence of the species but because it was so far at sea. Our bird came on board the trawler *Blue Foam* on or about October 31, 1952, on the Grand Banks, some 300 miles off the Newfoundland coast (lat. 43° 52' W) "after SE gales of hurricane proportions" according to information given Mr. Tuck by the trawler's crew. It died the following day.

The strong southeast winds mentioned by the crew of the *Blue Foam* occurred in the area on October 29, according to D.P. McIntyre, Meteorological Division, Department of Transport, who writes (in litt.) that these were associated with a "characteristic 'frontal depression' which at 1830 G.M.T.) of October 29, 1952 was an intense storm situated at the eastern end of Anticosti Island". However, the bird was not noted apparently until two days later, on October 31; consequently it was not necessarily carried there by the severe southeast winds from somewhere still farther at sea, a situation that would be difficult to account for. Possibly the Anticosti Island 'low' moved eastward and the egret was carried to sea with it or some other storm. The writer does not at present have access to the appropriate weather maps.

It should be mentioned that, farther south, on October 28 the hurricane 'Fox' had deteriorated to a disturbance of no great violence and was northwest of Bermuda. Earlier, on October 24, this hurricane from the western Caribbean Sea crossed Cuba. It swung eastward through the Bahamas on the two following days. Norton (1953, Monthly Weather Review 81 (1): 15) writes concerning it, "After clearing the Bahamas the storm swung back north to resume a more normal course, it was joined by an old polar front and became a wave disturbance of extra-tropical character. It moved north-eastward as a disturbance of no great violence and passed to the northwest of Bermuda on October 28". The writer has no additional facts concerning the later stages of the dissipation of this disturbance.

Our specimen is in winter plumage and color characters are therefore lacking. Its measurements are in mm.): exposed culmen, 55; wing (flattened), 243.5; tail, 90; tarsus,

79. Like the three specimens examined by Drury (op. cit.) from the western hemisphere, our bird appears to be small but probably is referable to the nominate race.

Because of the possibility of the occurrence of the Cattle Egret in Canada competent observers should examine closely any white herons they see here. In breeding plumage the Cattle Egret is white with buffish color on crown, nape, back, and breast. These buffish areas can be seen when carefully looked for under good observation conditions. The buffy areas are lacking in the autumn at which time the bird is all white. At any season the Cattle Egret can be separated from immature Little Blue Herons and the Snowy Egret (both white herons similar in size to the Cattle Egret) by its shorter, stouter, *yellow* or *orange* bill. The other two have dark-appearing bills. The American Egret, a white heron with a yellow bill, is a much bigger bird. Any white heron seen associating with cattle (although occasionally Snowy Egrets do this also) should be studied carefully.

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A warble fly, *Cuterebra* sp., reared from a house mouse, *Mus musculus*, in the vicinity of London, Ontario. — In the afternoon of August 27, 1953 Mr. J. Higgins, resident in Lobo Township, Middlesex Co., Ontario, found a mouse on the floor in his house. It was lying on its side and was curled up and the body and legs were twitching. As he watched the mouse, a warble larva one and one-quarter inches long and one-half inch wide squirmed through the skin between the hind legs and onto the floor. When examined an hour later by the writer the mouse was dead, having a circular hole one-half inch in diameter between the hind legs in front of the genital organs. This hole penetrated the skin and the muscles of the abdominal wall and led into a cavity in the coelom. This cavity, between the abdominal muscles and the digestive tract, extended forward along the right side of the viscera to the diaphragm. The mouse was later identified as a male house mouse, *Mus musculus*, by Dr. R. H. Stinson, Department of Zoology, University of Western Ontario.

The living larva was placed in a layer of earth one and one-half inches deep in a glass

jar covered with a tightly fitting lid and the soil was kept damp by sprinkling it with water from time to time. The jar was kept at room temperature in London. An adult warble fly emerged from the soil on March 1, 1954, this date being 186 days after the emergence of the larva from the mouse. In the soil was the empty puparium about one inch long.

The adult fly was pinned and deposited in the collection of the United States National Museum and has been identified as *Cuterebra* sp. *fontinella* Clark of authors) by Mr. C. W. Sabrosky, of the U.S.N.M., who pointed out (*in lit.*) that *fontinella* Clark is apparently a complex of species, as yet unseparated. Townsend (1917) included *fontinella* in the genus *Bogeria*, Austen (1845) separate from *Cuterebra*, Clark but Curran (1934) and later authors do not recognize this genus.

Warble larvae of the genus *Cuterebra* have been found infesting the house mouse, *Mus musculus*, by Scott and Snead (1942) in Iowa. The penetration of the larva into the coelomic cavity, as described by the present writer, appears to be unusual, for *Cuterebra* larvae are generally found in subcutaneous tissues. Dalmat (1943) found the larvae only under the skin when he conducted an examination of fifty mice.

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REVIEWS

Ninth Report of the Biological Bureau.

By Gustave Prévost et al.

Province of Québec, Game and Fisheries Department. Oct., 1953. 521 pp.

This report covers the work of the Biological Bureau for the period November 1, 1950 to April 1, 1952. It is printed in French and English, the French version on even numbered pages and the corresponding English version on the opposite odd numbered pages: this accounts for half the bulk of the report. Although the report is heavy to hold it is not heavy reading. Its avowed purpose, of "acquainting the public with the nature of our work", is admirably carried out. A great deal of useful information is presented in a well organized manner and in clear, interesting language.

The report begins with an account of the activities of the Mont Tremblant Biological Station founded by the Biological Bureau to do fundamental research work on the productivity and management of lakes. Albert Courtemanche describes the organization and activities of this station; Florian Grenier reports on a chemical study of Lake Lauzon; Bernard Cooper summarizes briefly the bacteriological work on sediments from the bottom of Lake Lauzon; Albert Courtemanche presents an interesting ichthyological inventory of Lake Lauzon in which a quadrat method was used to record the fish captured by various means in the lake. Tagging was also used to study the movements and populations of the speckled trout and white suckers, the only species found in the lake. This section concludes with an annotated list of the birds observed in Mont Tremblant Park by J. D. Cleghorn.

In the next section Gustave Prévost describes the Lachine Fish Hatchery; the raising of maskinonge is the chief subject discussed. Robert Dostert lists the cases of water pollution brought to the attention of the Biological Bureau and some of the remedial measures used to combat the pollution.

There follows a long section devoted to the inventory and improvement of waters in Québec, by Vianney Legendre. The author describes in some detail the organization and material used in making the inventories. The inventories are made for three purposes: (1) to determine whether fishes of game interest

should be planted, (2) to determine the species of organisms living in the water, (3) to determine the how and why of what goes on in the water. In twenty years some 1600 lakes and 100 brooks in 43 counties have been inventoried by the Biological Bureau. Incidentally a good deal of information on the fishes of Québec was amassed and the author presents a hundred page condensation of this in which he lists the species found in Québec, tells something of their distribution in and beyond the limits of the Province, and something of the history of the literature dealing with Québec fishes. He gives a very thorough account of recent proposals to do with the nomenclature of Québec fishes, and concludes with an account of the fishes of Lake St. John.

Following this the results of a number of miscellaneous studies are presented. The first, by Robert Lageux, is a study of the movements of Atlantic salmon tagged and released at kelt stage at Tadoussac, from 1943 to 1951 — a continuation of similar work by Rodd and Huntsman. A map of the recaptures shows that some of these salmon, released after having been stripped for spawn, have travelled as far as eastern Newfoundland and Labrador before being recaptured. The next paper, by Louis-Roch Séguin, reports on the relative merits of various artificial diets for feeding speckled trout. Another paper by the same author recommends the use of a copper paint to control algae in intensive fish-culture. A paper by Monique Lahaye-Desrochers follows in which she describes her technique for embedding biological specimens in bioplastic, a thermosetting polyester of resin. A list of the specimens embedded includes insects and crayfish and mammal skulls as well as numerous fishes. George Roussow reports on experiments and observations on the rearing and pathology of various fishes, on his work translating foreign texts, and presents a map showing movements of sturgeon tagged in the St. Lawrence near Montreal. This section concludes with a paper by Gustave Prévost describing a method of blackfly control costing about \$5.00 an hour to protect an area of about 10,000 square feet, but with no residual effect. The method would be of merit in making possible outdoor meetings of short duration in certain resort areas where blackflies now render such meetings too uncomfortable to be held outdoors.

The report concludes with lists of recent publications of the Bureau, of the educational activities of its members, a long report by the librarian, a brief mention of the fish collection, a list of distinguished visitors and a summary of the volume of correspondence dealt with by the Bureau. The library report is introduced by an account of the organization and the need for a well-organized library, by Vianney Legendre, and concludes with a list of the more important holdings of the library by Louis-Philippe Jolicoeur which will be of value to other librarians.

This report is a credit to the energy and broad interests of the able director of the Biological Bureau, Gustave Prévost, and his enthusiastic staff.

—J. MURRAY SPEIRS.

How Animals Move. *James Gray. Cambridge University Press and Macmillan Co. of Canada. Pp. i-xii, 1-114, 52 figs., 15 pls. \$3.25.*

Much has been heard in recent years about the unwillingness of the scientist to leave his ivory tower long enough to explain his work to the world; and some of the attempts that have been made to popularize a highly technical subject have not been completely successful. Here is a delightful little book that fulfills that aim lucidly and interestingly. The book is the substance of one year's series of Royal Institution Christmas lectures. The lectures, with the aid of motion pictures, models and live animals must have been truly fascinating; but the diagrams, high-speed photographs and clearly written text substitute successfully for these aids in the book.

Professor Gray describes briefly the actions of muscles and nerves as they apply to locomotion and maintenance of equilibrium. He then explains the mechanisms of a wide range of animal locomotion, including amoeboid and ciliary movement, the motion of leeches, various types of swimming, walking, and running, sinuous and other movements of snakes, various types of gliding and soaring, and the true flight of birds, bats and insects. One of the most impressive features is the unity of treatment pervading the chapters on aquatic and terrestrial locomotion. This treatment makes it easy for the reader to see the sort of way in which fins changed to limbs in

the evolution of a vertebrate land fauna, although the author avoids suggesting the actual course of evolution.

So much is clearly told in a short space that I hesitate to venture any criticism. Possibly the sections on soaring and flapping flight are not quite up to the high standard of the other chapters. Figure 49, illustrating thermal soaring, suggests that columnar up — and down — drafts occur side by side; but I think a truer picture is that of columnar up-drafts in a matrix of slowly subsiding air. It is possible that too much mystery has been made of the soaring of albatrosses here as in other works. The largest species of albatross are virtually confined to the zone of strong westerly winds in the southern oceans; there, even when the wind does drop, there is always a long swell over which there will generally be mechanical up-drafts that an albatross could utilize. A viewing device incorporating an artificial horizon is probably necessary in studying a bird's relationship to these swells a mile or so long. Although it is correctly stated that an aerofoil derives most of its lift from the upper surface, the Venturi principle, which governs this phenomenon, is not explained. Possibly as a consequence of this omission the aerodynamic slots provided by alula and by emarginated primaries, perhaps the most important distinction between the wings of birds and those of other animals, are not treated.

Any naturalist will profit from reading this book and will thereafter get added enjoyment from watching animals. Although the lectures were addressed to a juvenile audience, I doubt if a few parts of the book would be fully grasped by a youngster before he reached his second year in high school. To the professional biologist parts of the text may seem elementary and superficial, but he also will find much of interest. To one interested in evolution and natural classifications the most striking lesson that this book teaches is the ease and frequency with which adaptive mechanisms or structures evolve in unrelated groups as an aid to such an important function as locomotion. The botanist will see an analogy with dispersal mechanisms for seeds and spores, several of which have been developed over and over again.

—D.B.O. SAVILE.

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The CANADIAN FIELD-NATURALIST

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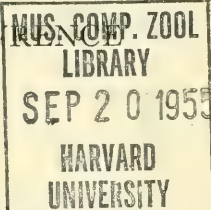
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SHALLOW-WATER MYSIDACEA FROM THE ST. LAWRENCE ESTUARY, EASTERN CANADA¹

O. S. TATTERSALL, D.Sc.

Hayling Island, Hants.



I AM greatly indebted to Dr. E. L. Bousfield, National Museum of Canada, for the opportunity of examining this most interesting collection of mysids which were collected by him during the summers of 1951 and 1953 from the shores of the St. Lawrence estuary and from Chaleur Bay. Three species were identified from the material; two, *Mysis stenolepis* S. I. Smith and *Neomysis americana* S. I. Smith, have previously been recorded from the area (e.g. Schmitt, 1904; Prefontaine, 1931) and one *Mysis gaspensis*, is new to science. The station list of material is given in Table 1.

The collections made during the summer of 1951, at the head of Gaspé Bay (St. Majotique), and the Gaspé shore of Chaleur Bay (St. Bonaventure), yielded four immature females of a Mysid which do not agree in form with published descriptions but which possess characters intermediate to those of the marine *Mysis oculata* Fabr. and the fresh-water *M. relicta* Loven. During the summer of 1953 further collection of Mysids were made at 42 stations on north and south shores of the St. Lawrence estuary from Quebec city to Anticosti Island and Gaspé Bay, and the north shore of Chaleur Bay. Numerous nearly adult specimens of both sexes of the new form were taken at 31 of the stations (Table 1). A re-examination of specimens collected at Kitty's Cove near St. Andrews, N.B., Sept. 15, 1917, and now in the National Museum, yielded four more. On the suggestion of Dr. Bousfield I have named the new species *Mysis gaspensis*.

HISTORICAL

When Lovén (1861, p. 285) first described *Mysis relicta* from two fresh water lakes in Sweden, he realised at once that it was closely

related to *Mysis oculata* Fabr., a marine species with a wide distribution in Arctic waters. He considered it to be a relict form which had been isolated by profound glacial changes in very remote times and had become adapted to a fresh water habitat, undergoing various morphological changes in the process.

Mysis relicta has since been recorded from fresh water in Norway, Finland, West Russia, Germany, Denmark, N. Italy, England, Ireland and North America as well as from brackish water in the Baltic, the Gulf of Bothnia and lagoons connected with fiords on the northern shores of Europe and Asia from Spitzbergen to Anadyr Bay.

Attempts have been made by various workers to trace some kind of intermediate forms or varieties between the purely marine *M. oculata* and the fresh or brackish water *M. relicta*. If the latter has been derived from the former it is logical to suppose that animals which have become acclimatised to intermediate conditions as regards salinity might show a tendency to develop characters resembling *M. oculata* in some respects while resembling *M. relicta* in others.

Olofsson (1918, pp. 373-381) records what he considers to be intermediate forms from a fiord and lagoon near Spitzbergen. Here he found *M. relicta* living in varying salinities from quite fresh water in the lake at the head of the fiord and brackish water in the lagoon, which was fed with salt water at high spring tides, to the salt water of the fiord itself. Although it is true that some morphological changes can be found to be correlated with the differences in habitat, the two outstanding specific differences which separate *M. relicta* from *M. oculata* remain unchanged i.e. the shape and proportions of the antenna and the character of the telson, more particularly the armature of its lateral

¹) Originally received for publication February 11, 1953; subsequently revised by the author.

TABLE 1. Station List of Material.

Station	Date	Location	Material
N.10	5/9/53	Port au Saumon, Quebec	<i>Mysis gaspensis</i> , 1 imm. ♀, 15.6 mm. with very small oostegites.
N.14	4/9/53	Baie Ste Catherine, Que.	<i>M. gaspensis</i> , imm. ♀, 18 mm. <i>M. stenolepis</i> , 2 imm. ♀♀, 22.4 mm., 2 frag.
N.16	3/9/53	Moulin a Baude, Que.	<i>M. gaspensis</i> , 1 imm. ♀, 15 mm.
N.17	2/9/53	Pte a John, Que.	<i>M. gaspensis</i> , 3 juv. ♂♂, 16-18 mm.
N.18	2/9/53	Les Escoumains, Que.	<i>M. gaspensis</i> , 5 imm. ♂♂, 17-18 mm., 5 imm. ♀♀, 16-17 mm. MALE TYPE
N.29	28/8/53	Rageneau, Que., Outardes estuary	<i>Neomysis americana</i> , 1 ovig. ♀, 13.2 mm.
N.33	28/8/53	Pt. aux Outardes, Que.	<i>M. gaspensis</i> , 4 imm. ♂♂, 13-15 mm., 4 imm. ♀♀, 12-13 mm. <i>N. americana</i> , 1 ♂, 8.8 mm., 2 ovig. ♀♀, 10.5 and 11.5 mm. and 2 fragments.
N.34	29/8/53	Pt. Lebel, Que.	<i>N. americana</i> , 6 ovig. ♀♀, 10.5-14.5 mm., 1 juv. 9 mm.
N.35	29/8/53	Manikouagan, Que., old wharf	<i>M. gaspensis</i> , 1 imm. ♂, 18 mm., <i>N. americana</i> , 1 small juv.
N.37	27/8/53	Baie Comeau, Que.	<i>M. gaspensis</i> , 3 imm. ♂♂, 12.5-14 mm., 1 juv.
S. 8	10/9/53	L'Islet, Que.	<i>N. americana</i> , 4 ad. ♀♀, 8-9 mm., 2 frag.
S.10	16/7/53	St. Roch des Aulnets, Q.	<i>N. americana</i> , 1 ad. ♂, 8 mm., 9 ad. ♀♀ (4 ovig.) 8-9 mm. <i>M. stenolepis</i> , 5 imm., 18.8-19.2 mm., 1 ♂ 21.5 mm. (appendages mounted).
S.12	16/7/53	Pte aux Orignaux, Que.	<i>M. stenolepis</i> , 11 immature (too small to identify sex).
S.14	18/7/53	Pte des Caps, Que.	<i>M. stenolepis</i> , 1 imm. ♀, with very small oostegites. <i>N. americana</i> , 3 juv.
S.16A		Cacouna Island, Que., East End.	<i>M. stenolepis</i> , 7 very juv. specimens.
S.22	13/7/53	Bic Wharf, Que.	<i>M. gaspensis</i> , 3 imm. ♂♂, 9-10.5 mm., 1 ♀ with large empty brood sac, 20 mm., 1 juv. ♀, 10 mm.
S.23	12/7/53	Bare Island, Que., near Rimouski.	<i>M. gaspensis</i> , 2 ♀♀ with large empty brood sacs, 20 juv. (too small to ascertain sex).
S.27	11/7/53	Pt. au Pere, Que., E. of Wharf.	<i>M. stenolepis</i> , 10 juv.
S.27A	11/7/53	Pt. au Pere, Que., W. of Wharf.	<i>M. gaspensis</i> , 1 juv. ♀, 11.5 mm. <i>M. stenolepis</i> , 1 juv. ♂, 10 mm., 1 ♀, 10 mm., 7 small juv.

TABLE 1. — Continued.

Station	Date	Location	Material
G. 1	9/7/53	Ste. Flavie, Que. 1 mi. west.	<i>M. stenolepis</i> , 2 juv. ♂♂, 9 mm., 3 juv. ♀♀, 8-10 mm., 4 small juv.
G. 3	18/8/53	Little Metis Bay, Que.	<i>M. gaspensis</i> , 1 ♂, 12.5 mm., 5 ♀♀, 12-12.5 mm., all immature.
G. 6	26/8/53	Pte. au Naufrage, Que.	<i>M. gaspensis</i> , 4 imm. ♂♂, 13-14 mm., 1 ♀, 14 mm.
G.16	23/8/53	La Lorraine Cove, Que.	<i>M. gaspensis</i> , 2 imm. ♂♂, 13.5 mm., 3 imm. ♀♀, 13 mm.
G.20	21/8/53	Capucins, Que., estuary.	<i>M. gaspensis</i> , 6 imm. ♀♀, 14 mm., 2 juv.
G.23	23/8/53	Cap Chat, Que., estuary.	<i>M. gaspensis</i> , 3 ♂♂, 9 ♀♀, 12-13 mm.
G.25	23/8/53	Ste Anne des Monts, Que., estuary.	<i>M. gaspensis</i> , 1 imm. ♂, 14 mm.
G.34	14/8/53	Riviere Madeleine, Que., estuary.	<i>M. gaspensis</i> , 4 imm. ♂♂, 13 mm.
G.39	13/8/53	Grand Etang, Que.	<i>M. gaspensis</i> , 1 ♀ with well developed oostegites, 19 mm., 11 juv. about 10 mm.
G.50	25/7/53	Peninsula Gaspé, Que.	<i>M. gaspensis</i> , 1 ♀, 12.5 mm., imm. <i>N. americana</i> , 1♂, 8 mm., 2 ovig. ♀♀, 13.5 and 10 mm., 1 juv.
G.54	24/8/53	St. Majorique, Que. estuary.	<i>M. gaspensis</i> , 24 juv., 10 mm.
G.56	28/7/53	Gaspé Bay, Que., York estuary.	<i>M. gaspensis</i> , 1♀, 19 mm., 2 juv. ♂♂, 5 juv. ♀♀. <i>N. americana</i> , 1 ad. ♂, 8 mm., 1 imm. ♀, 7 mm. <i>M. stenolepis</i> , 1 juv., 2 fragments.
G.58	28/7/53	Sandy Beach, Gaspé Bay, Que.	<i>M. gaspensis</i> , 2 juv. <i>N. americana</i> , 4 ovig. ♀♀, 9-10 mm.
A. 1	9/8/53	Port Menier, Anticosti Is., Que.	<i>M. gaspensis</i> , 3 imm. ♂♂, 10.5-11.5 mm., 4 imm. ♀♀, 11-11.5 mm.
A. 3	11/8/53	Baie Ste Claire, Anticosti Is., Que.	<i>M. gaspensis</i> , 8 imm. ♂♂, 2 imm. ♀♀, 10.5-11 mm.
A. 4	10/8/53	Cap de Rabast, Anticosti Is., Que.	<i>M. gaspensis</i> , 16 imm. ♂♂, 11-12.5 mm., 11 imm. ♀♀, 11-12 mm.
C. 1	7/8/53	Maria, Que., old wharf.	<i>M. gaspensis</i> , 1 imm., 10 mm., <i>N. americana</i> , 2 ad. ♂♂, 8.8 mm, ♂♂, 8.2 mm., 2 ad. ♀♀ (ovig.) 9.9.5 mm., 1 imm. ♀.

TABLE 1. — Continued.

Station	Date	Location	Material
C. 2	7/8/53	Cascapedia R., Que., estuary.	<i>M. gaspensis</i> , 11 juv. (too young to ascertain sex). <i>N. americana</i> , 3 ad. ♀♀, 11 mm.
C. 3	6/8/53	Little Cascapedia, Que.	<i>M. gaspensis</i> , 1 juv. ♂, 10 mm., 8 juv. ♀♀, 1 ♀, with large oostegites, 17.5 mm.
C.14	3/8/53	Chandler Bay, Que., head.	<i>M. gaspensis</i> , 1♀, with large oostegites, 17.5 mm., 9 juv. (too young to ascertain sex). <i>M. stenolepis</i> , 2 imm. ♀♀, 16.5 mm.
C.15	2/8/53	Chandler Bay, Que., mouth.	<i>M. gaspensis</i> , 1 imm. ♀, 11.5 mm. <i>N. americana</i> , 2 ad. ♂♂, 9.5 mm.
C.20	30/7/53	Grande Riviere, Que.	<i>N. americana</i> , 2 ovig. ♀♀, 8 mm., 8 juv.
	9/51	St. Majorique, head of Gaspé Bay.	<i>M. gaspensis</i> , 2 imm. ♀♀, 12.8-13 mm.
	9/51	St. Bonaventure, south shore of Gaspé Peninsula.	<i>M. gaspensis</i> , 2 imm. ♀♀, 12.8-13.2 mm.
	15/9/17	Kitty's Cove, St. Andrews, N.B.	<i>M. gaspensis</i> , 3 imm. ♂♂, 12-13 mm., 1 imm. ♀, 12.5 mm., 1 large. <i>M. stenolepis</i> in 2 pieces.

margins and the shape and depth of the apical cleft. Even very young specimens of *M. relict*a just released from the brood pouch can be clearly recognised on these characters.

In a very interesting paper on possible intermediate forms between *M. relict*a and *M. oculata* Holmquist (1949, pp. 3-26) discussed the relationship between the two species and thoroughly reviewed the published works on the question. After close examination of the literature and of fresh material of *M. relict*a from brackish water fiords and lagoons in the north of Norway, she concluded that no definite intermediate forms had yet been found between these two species although *M. relict*a can be grouped into geographical races which, in some respects, do show a convergence towards *M. oculata*. Even in these, however, there is no difficulty in determining to which species the individuals belong, since the main specific characters remain distinct.

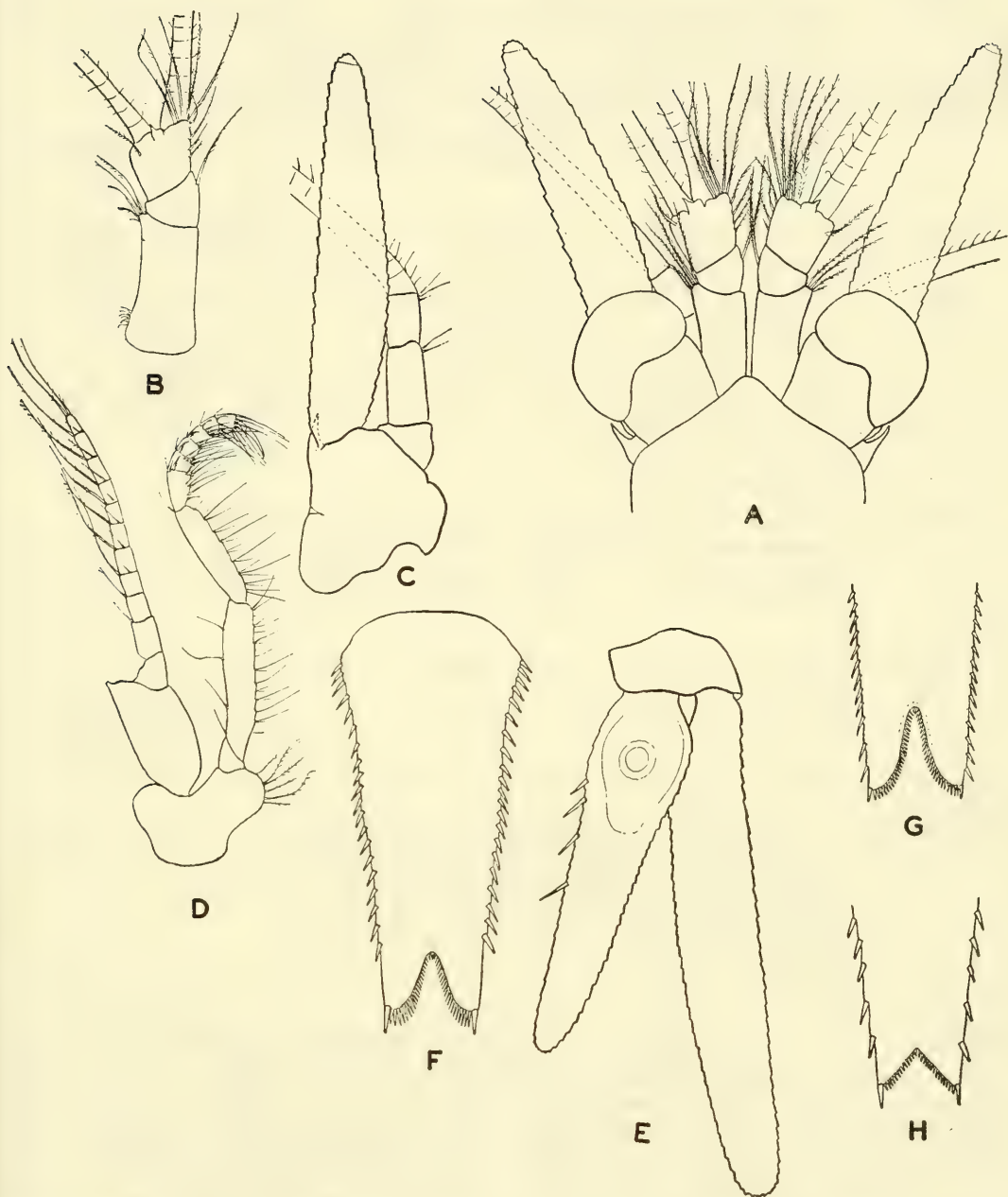
It is, therefore, particularly interesting to find in these specimens from brackish water of widely varying salinities in the Gulf of the St. Lawrence conditions which are inter-

mediate between *M. relict*a and *M. oculata* as regards those specific characters which so clearly distinguish these two species. The proportions of the antennal scale in these specimens from around the Gaspé Peninsula lie between those described for *M. oculata* and *M. relict*a and the telson shows some characters of the one and some of the other of these species. It would appear that we really have here the long suspected intermediate form between the purely marine *M. oculata* and the fresh, or slightly brackish water *M. relict*a.

Mysis gaspensis n. sp. Figs. A — O.

Occurrence:—

- 1917. Kitty's Cove, St. Andrew's, N.B.
- 1951. St. Majorique, head of Gaspé Bay; St. Bonaventure, N. shore of Chaleur Bay.
- 1953. Stations N.10; N.14; N.16; N.17; N.18 (*Male Type* — in National Museum of Canada); N.33; N.35; N.37; S.22; S.23; S.27A; G.3; G.6; G.16; G.20; G.23; G.25; G.34; G.39; G.50; G.54; G.56; G.58; A.1; A.3; A.4; C.1; C.2; C.3; C.14; C.15.



Mysis gaspensis n. sp. A. Anterior end in dorsal view. B. Antennular peduncle. C. Antenna. D. Third thoracic appendage. E. Uropod. F. Telson. G. Distal half of telson of *M. oculata* (after G. O. Sars). H. Distal half of telson of *M. relicta* (after G. O. Sars).

TABLE 2. Comparison of characters of *Mysis oculata*, *M. gaspensis* and *M. relicta*.

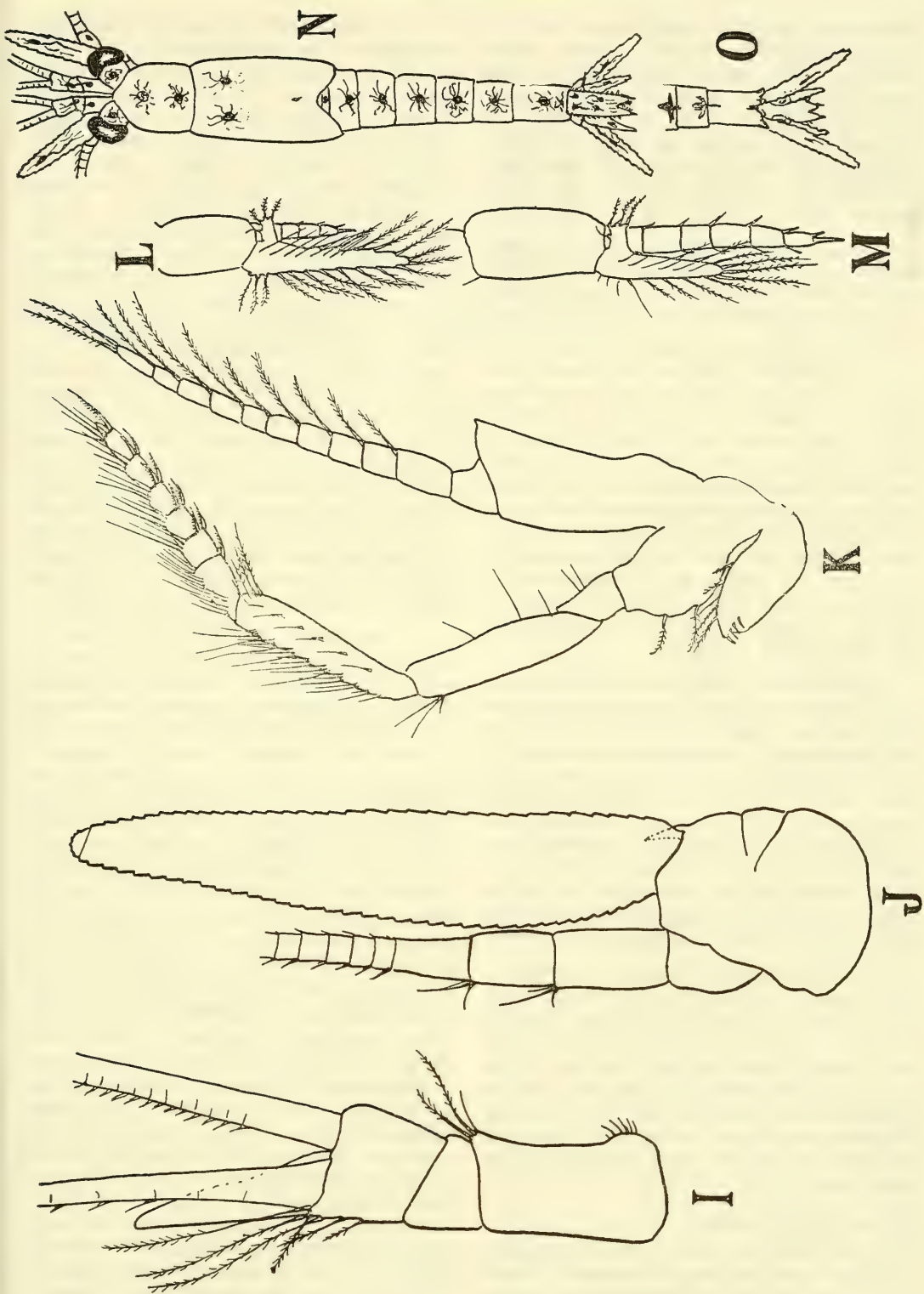
Organ	<i>Mysis oculata</i>	<i>M. gaspensis</i>	<i>Mysis relicta</i>
	from Sars' drawings of an immature male	immature females	immature females
Antenna	5-6 times as long as broad	5-5.1 times as long as broad	4 times as long as broad
Scale	antennular peduncle 37.5% of length of scale	antennular peduncle 43% of length of scale	antennular peduncle 47.5% of length of scale
Uropod	7 spines on inner margin of endopod	4 spines on inner margin of endopod	3-4 spines on inner margin of endopod
Telson	2½ times as long as broad at base 25-27 spines on each lateral margin, extending from base to apex with at least 4 spines posterior to base of cleft (fig. G)	2¼ times as long as broad at base 20-22 spines on each lateral margin, the posterior one anterior to the base of cleft (fig. F)	2½ times as long as broad at base 19-20 spines on each lateral margin, the posterior lateral spine anterior to the base of cleft (fig. H)
Telson-cleft	narrow, with margins convex near apex then nearly parallel to the rounded base	more widely open with margins convex near apex, thence converging gradually to the rounded base	widely open with margin straight, converging to an obtuse angle at the base
Depth of Cleft	18-25% of length of telson	14.3% length of telson	usually 8-12% of length of telson but has rarely been found to be as much as 17%
No. of teeth in cleft	23-25 on each side	19-20 on each side	15-18 on each side
Eyes	Very large, extending forward beyond distal margin of second segment of antennular peduncle	Not so large as in <i>M. oculata</i> , extending to distal end of first segment of antennular peduncle	Similar to those of <i>M. oculata</i>

Remarks:

This species so closely resembles *M. oculata* and *M. relicta* in general form that it will suffice to point out those characters whereby it may be distinguished from them. I have therefore set these out in tabular form (Table 2) and have made figures of them for purposes of comparison. (figs. A—O).

The most striking character in *M. gaspensis* is the form and armature of the telson and this can already be seen in the smallest specimens at my disposal. In *M.*

oculata the lateral margins of the telson are armed with 25-27 spines which extend regularly from the base to the apex with at least four spines distal to the base of the cleft. The cleft is deep and narrow with its margins strongly convex near the apex (fig. G). In *relicta* the lateral margins bear 15-18 spines which are relatively larger than in *oculata* and extend from the base to the level of the base of the cleft, leaving an unarmed portion down to the apical spine. The cleft is usually very shallow and is always widely open with its margins straight



Mysis gaspensis immature male from St. N. 18. I. Antennule immature male x 40. J. Antennal scale x 40. K. 8th thoracic appendage x 40. L. 3rd pleopod. immature male x 50. M. 4th pleopod immature male x 50. N. Diagram of dorsal surface. O. Diagram of ventral surface of posterior end.

and meeting in about a right angle (fig. H). In *M. gaspensis* the telson is clearly intermediate in both form and armature. The lateral margins are armed with 20-22 spines, extending from the base of the telson to the level of the base of the cleft. The cleft is moderately deep, more widely open than in *oculata* but with the distal portion of its margins convex (fig. F). (3 figs. F, G, H).

In all three species there is a well marked ocular papilla on the dorsal surface of the eyestalk about one third of its length from the proximal margin.

In very young specimens of *Mysis oculata* the posterior end of the telson does resemble that of *Mysis relicta* in some respects, the cleft being less narrow and its margins less convex than in larger specimens (see G. O. Sars, 1879, Pl. XXXV, fig. 10). But even in animals which have just been released from the brood pouch the spines arming the lateral margins of the telson extend right to the apex without leaving the noticeable gap which is so characteristic a feature of *Mysis relicta*, whilst the angle at the base of the cleft is more rounded and less obtuse than in *relicta*.

The form of the anterior end of the animal in *M. gaspensis* closely resembles both the other species under discussion except in the size of the eyes which are relatively smaller, extending forward barely beyond the distal margin of the first segment of the antennular peduncle (fig. A). The mandibles, maxillae and first two pairs of thoracic appendages present no noteworthy differences from those of *oculata* or *relicta*. In the remaining thoracic appendages the carpopropodus is divided into 7 sub-segments (fig. D.).

M. oculata has a circumpolar distribution in the colder waters of the northern hemisphere and is a definitely marine form although it has been recorded from estuarine waters with a lower salinity than that of the open ocean. *M. relicta*, for long regarded as a purely fresh water species, has been recorded from brackish water on a number of occasions but has not yet been taken in the open ocean.

Chromatophore system:

In common with other mysids living in shallow coastal waters, *M. gaspensis* has a very well developed chromatophore system. The arrangement of the chromatophores is constant even in very small specimens and

forms a useful guide in the identification of the species. The arrangement on the dorsal surface is shown in the diagram (fig. N) and the four dark spots on the telson are most distinctive. When fully contracted the chromatophores appear as dark roundish spots on the carapace, the abdominal somites and the telson but on the antennules, antennal scale and uropods they are long and narrow. When expanded they form very lovely arborescent patterns all over the surface of the body, extending down the lateral surfaces of the carapace and abdomen. On the ventral surface of each abdominal somite there is one large chromatophore in the form of a cross with the transverse arm running across the somite close to its posterior margin (fig. O). The branches from the dorsal and the ventral chromatophore on each somite are more dense in the median region and as the pigment flows into them a dark band of colour appears around the middle of each somite, shading off to a paler colour towards the anterior and posterior margins. As a result the abdominal region has a "banded" appearance which is very characteristic.

On the ventral surface of the head and the thoracic region the chromatophores are arranged as follows:— a single large medium one at the anterior end between the bases of the antennules with branches running from it along the proximal portion of these appendages; one large area, which may be one chromatophore or a pair so close together that they appear as one, covering the mouth area; one pair between the bases of the third and fourth thoracic appendages; one pair between the fifth and sixth pairs; one pair between the seventh and eighth pairs and a single median one on the sternum of the last thoracic somite. In addition there is one large one on each eyestalk and one on the outer side of the sympod of the antenna.

In both *M. oculata* and *M. relicta* the chromatophores on the dorsal surface of the body are fewer and less clearly defined than in *M. gaspensis*. Anterior to the cervical sulcus there is only one median pigment spot and posterior to the sulcus there is only a single median one instead of the well marked pair which is present in *M. gaspensis*. Occasionally there may be a very small median chromatophore near the posterior margin of the carapace. The arrangement of the chromatophores on the abdominal somites is the same in all three species but in *oculata* and *relicta* they are smaller and

TABLE 3. Comparison of characters of *M. mixta*, the St. Lawrence form, and *M. stenolepis*.

Organ	<i>M. mixta</i>	St. Lawrence specimens.	<i>M. stenolepis</i>
Antennal scale	9 times as long as broad; outer margin nearly straight. 6 times as long as 2nd. segment of peduncle.	10.5 times as long as broad; outer margin concave; 8.5 times as long as 2nd. segment of peduncle.	12 times as long as broad; outer margin concave; 10 times as long as peduncle.
Antennal peduncle	2nd. segment $\frac{1}{3}$ rd longer than 3rd.	2nd. segment slightly longer than 3rd.	2nd. segment subequal to 3rd.
Thoracic endopods	18 subsegments in carpopropodus of 3rd — 7th pairs; 7 in 8th pair.	3rd-7th pairs with 13 subsegments; 8th with 12.	10 subsegments in 3rd — 7th pairs; 9 in 8th pair.

rounder when contracted, appearing as small black dots especially on the ventral surface. The most striking difference is shown in the arrangement of the chromatophores of the telson. Instead of the characteristic four which occur in *M. gaspensis* there is only one pair situated very close to the base in both the other species.

Length: None of the specimens present is mature. Largest male (very immature), (see figs. I, K, L), 19 mm.; largest female, with well developed but empty brood sac, 22-24 mm.

Breeding: — Since there are no breeding individuals and since the average size of the specimens increases as summer advances, it would appear that this species is, like *M. relictæ* a winter breeder.

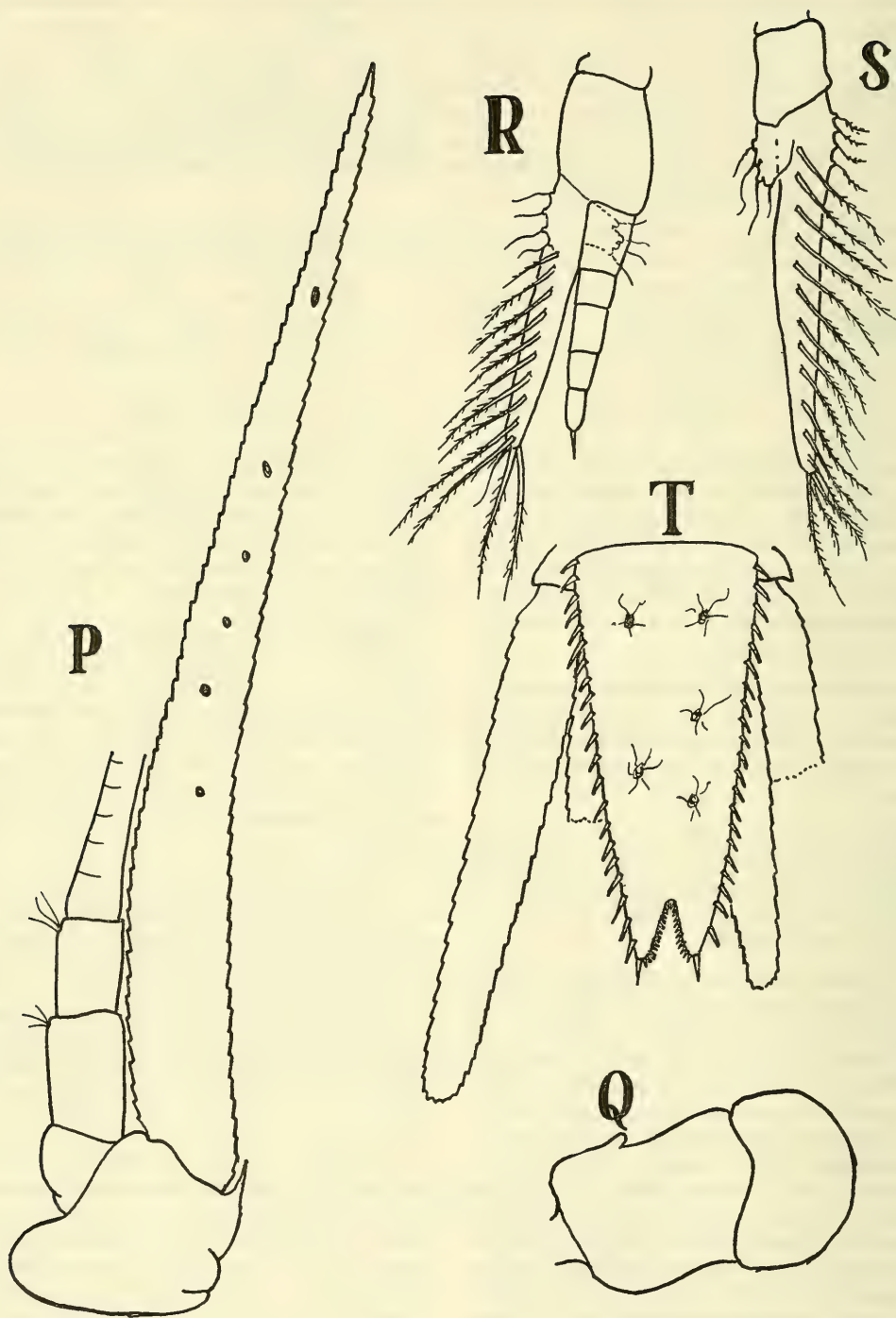
The differences in the form and armature of the telson between *M. oculata* and *M. relictæ* are almost precisely the same as those which distinguish the two related species *Mysis mixta* Lilljeborg and *Mysis stenolepis*. In *Mysis mixta* which frequents coastal waters with a high salinity the telson resembles that of *M. oculata*. The cleft is very deep and narrow with its margins markedly convex near the apex. The spines arming the lateral margins of the telson extend regularly to the apex without leaving any gap distally (fig. U). In *M. stenolepis*, which is a euryhaline, littoral form widely distributed along the eastern shores of North America, the form of the telson resembles that of *M. relictæ* which lives in fresh water or more rarely, in water of very low salinity. The cleft is relatively shallow and widely

open with its margins only slightly convex distally. The most distal lateral spines of the telson are inserted anterior to the level of the base of the cleft, leaving a distinct unarmed gap between them and the long apical spine on each side.

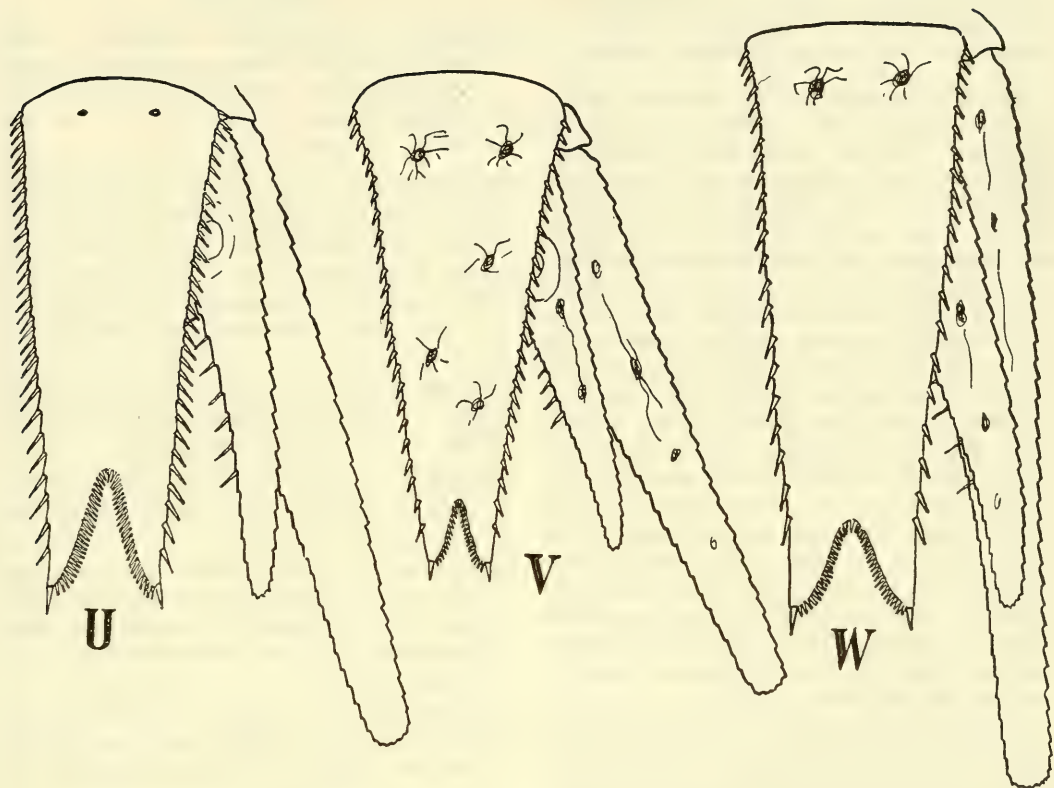
Whether this parallelism indicates that variations in salinity do induce morphological changes is difficult to say but it is interesting to note that in these specimens of *M. gaspensis* from the shores of the Gaspé Peninsula, where there is a wide range of salinity, the telson strikingly resembles that of *M. stenolepis* which is itself a highly euryhaline form.

The presence in this collection of a number of specimens in which the proportions of the antennae and the form and armature of the telson show intermediate characters between those of *M. mixta* and *M. stenolepis* strengthens the suggestion that parallel evolution has taken place and that *M. stenolepis* has been derived from *M. mixta* just as *M. relictæ* has been derived from *M. oculata*.

M. mixta and *M. stenolepis* are sharply marked off from all other known species of the genus by the form of the antennal scale which is very long and narrow with an acutely pointed apex and no trace of a distal articulation. Norman (1902) felt that this character was of generic significance and suggested that *M. mixta* and *M. stenolepis* should be placed in a new genus which he called *Michtheimysis*. Some workers accepted Norman's new genus and records have been made under both names indis-



Mysis stenolepis S 10. P. Antennal scale immature male x 40. Q. Lateral view of eye. R. 3rd pleopod of immature male x 40. S. 4th pleopod of immature male x 40. T. Telson and uropods of immature female St. S. 27A x 40.



U. Telson of *Mysis mixta*. V. Telson of *Mysis stenolepis* from Gaspe Peninsula. W. Telson of *Mysis stenolepis* from Wood's Hole.

criminally. Zimmer (1915) regarded the form of the scale as insufficient for a generic character and cancelled *Michtheimysis* as a synonym of *Mysis*.

The genera *Neomysis* and *Acanthomysis* are separated from one another on precisely the same differences in the antennal scale as are present in the genus *Mysis* and the cancelled genus *Michtheimysis* but these two genera have been retained for convenience in classification since the genus *Neomysis* was becoming unwieldy owing to the addition of many new species. More recent work has revealed the presence of other characters of generic significance to distinguish *Neomysis* from *Acanthomysis*.

***Mysis stenolepis* S. I. Smith.**
(Figs. P—W).

1873. *Mysis stenolepis* S. I. Smith, p. 551;
1879, p. 103.
1874. *Mysis stenolepis* Verrill, p. 135.
1951. *Mysis stenolepis* Tattersall, W. M., p.
170, figs

Occurrence:—

Stations N.14; S.10; S.12; S.14; S.16; S.17;
S.27; S.27A; S.28; G.1; Kitty's Cove, near St.
Andrews, N.B.; Pass Bay, N.B. (7/9/51).

Remarks:—It is with some hesitation that I refer specimens taken at the above stations to *Mysis stenolepis* S. I. Smith. The antennal scale is long and acutely pointed with no trace of a distal articulation. But in the same way that *M. gaspensis* occupies an intermediate position between *M. oculata* and *M. relicta* these specimens from eastern Canadian waters show intermediate characters between the marine *M. mixta* Lilljebord and the littoral euryhaline *M. stenolepis* S. I. Smith. Unfortunately there is considerable variation among the specimens so that it is not possible to draw up a definite set of characters which might justify the formation of a new species for them. Rather do they suggest a transition between the two established species, indicating possibly the lines along which evolution has proceeded if the suggestion put forward by other

workers is correct — that *M. stenolepis* has been derived from *M. mixta* as a result of penetration into waters of lower salinity.

In all the specimens the shape of the antennal scale (fig. P) resembles that of *M. stenolepis* with the outer margin markedly concave, but the proportions of the length to the breadth of the scale and the relative lengths of the second and third segments of the peduncle are intermediate between those of *mixta* and *stenolepis*. The depth of the cleft of the telson varies considerably but it is as a rule less than in either *mixta* or *stenolepis*. In nearly all the present specimens the spines arming the lateral margins of the telson are arranged as in fig. V, but there are a few in which the distal lateral spine is level with the base of the cleft, leaving an unarmed region distally as in *M. stenolepis*. In a few others there is one spine distal to the base of the cleft on one side only of the telson and the other side is as in *stenolepis* while in an immature individual from station S.27A (fig. T) there are two spines in this position on one side and one on the other.

I have examined numbers of specimens of *M. stenolepis* from Woods Hole and Vineyard Sound and in none is there any variation from the published description and figures of the species.

An examination of the chromatophore system did not throw any further light on the situation. There are, as in *stenolepis*, many chromatophores but I was unable to discover any constant pattern in their arrangement. On the telson there is always a pair of large spots close to the base and there may be from three to five large spots distal to these. There is one large median chromatophore on the dorsal surface of each abdominal somite with, on the sixth somite only, a second smaller one near the posterior end. On the ventral surface there is one large spot near the posterior margin of somites 1-5. On the uropods and the antennal scale there are several spots arranged in an irregular row.

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A REVISION OF THE POCKET GOPHER *THOMOMYS TALPOIDES* IN BRITISH COLUMBIA¹

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IN 1949, Mr. J. A. Munro of Okanagan Landing, B.C., suggested to the writer that field work be jointly undertaken, with a view to obtaining the information necessary to revise, and clarify the geographic distribution in British Columbia, of the several subspecies of the pocket gopher *Thomomys talpoides*. The direct result of this suggestion was the collection of study skins, and skulls, of this mammal throughout its range in the Province. When this pertinent material was assembled it became immediately apparent, after only a cursory examination, that a series of specimens from Wynndel, and another from the Crowsnest Pass area, showed remarkable external differences when compared with series of specimens from elsewhere in the Province. Subsequent analysis, and critical comparisons of this material with series of topotypes and specimens from nearby areas, resulted in the naming of two new subspecies, herein after described.

The writer wishes to gratefully acknowledge the help so freely given by Mr. Munro, together with the use of his collection of specimens: also greatly appreciated are the kind criticisms, and suggestions for the preparation of this paper, by Doctor I. McT. Cowan, Doctor Murray Johnson and Mr. Kenneth Walker. Special thanks are extended to the Museum of Vertebrate Zoology, University of California, and Puget Sound Museum of Natural History, Tacoma, Washington, for the loan of series of topotypes of *T. t. fuscus* and *T. t. saturatus*.

Until the time that this investigation commenced, little work on the occurrence and distribution of the pocket gophers in British Columbia had been undertaken; in consequence, existing published literature on the subject is, at the best meager and inconclusive.

The pocket gophers of British Columbia, being relatively recent immigrants, are of particular interest to naturalists and biologists, and represent a post-glacial invasion from the south; an invasion that is still in progress, and at present occupies only a

narrow strip of territory along the southern boundary of the Province.

The purpose of this paper is to define the northern limits of this invasion, as currently known; map the areas of distribution, and describe two new sub-species. What follows is an attempt to correlate information already established with data obtained through recent field work, in conjunction with the critical examination of some five hundred specimens collected throughout the area under review.

Throughout most of the range of *Thomomys talpoides* in British Columbia, the country is extremely rugged, and made up almost entirely of parallel north-to-south mountain ranges and valleys of varying widths. Some of these valleys are occupied by lakes and rivers of considerable size. Later it will be shown how these large water courses and lakes had a profound effect on distribution by presenting barriers to further expansion, and preventing cross-migration and gene-flow between neighbouring races.

Owing to their inaccessibility, many of the mountainous areas are, from a naturalist's point of view at least, comparatively unexplored, but it is known that the high mountains, as well as the valleys, harbour populations of gophers. The colony on the summit of Toad Mountain, near Nelson, the type locality of *Thomomys talpoides medius*, would appear to be isolated; hemmed in by a terrain rocky and precipitous in the extreme, and so heavily clothed with sub-alpine forest growth, that further contact with others of the race would seem impossible.

The demarkation of the boundaries which limit the distribution of *Thomomys talpoides medius* is precise. Water barriers are formed by the northward flowing Kootenay River on the east, Kootenay Lake on the north; on the west the continuation of the Kootenay River after it flows out of Kootenay Lake until it joins the Columbia River at Castlegar, and then the Columbia River which leaves the Province at Waneta. The distribution of *medius*, therefore, is confined to an area bounded by water barriers that

¹ Received for publication April 26, 1954.

would seem to preclude any further expansion beyond this area. There is no evidence to show intergradation with neighbouring races, but *medius* shows similarity to the *fuscus* pattern; doubtless, its subspecific characteristics have been evolved within its present range.

Thomomys talpoides saturatus immigrated from the south, either from north-eastern Idaho or north-western Montana, infiltrating up the west side of the Moyie River as far north as Yahk. To the east, north from the International Boundary in the Kootenay River valley, *saturatus* occupies the west side of the river. Here again this river is an important factor in pocket gopher distribution, forming a definite barrier that prevents *saturatus* from crossing and colonizing the country to the east, now occupied by another race, *Thomomys talpoides cognatus*, a new subspecies described elsewhere in this paper. In this area there is no evidence to show that either subspecies has crossed to the opposite side of the river.

Northward up the valley, conditions change. Upstream from Wardner the river remains frozen over for long periods in severe winters, and the ice, covered by heavy falls of snow, evidently afforded the means by which gophers could cross to the other side of the river; an inference drawn from the fact that both sides of the valley are here populated by *saturatus*, as far as the limit of their northern range at Wasa. This crossing however, was apparently too far north to permit the intermingling of *saturatus* and *cognatus*, for the latter's western limit swings north and eastward, and between these two races there intervenes an effective barrier, formed by a precipitous range of the Rocky Mountain system.

The distribution of *Thomomys talpoides fuscus* in British Columbia is confined to the southern sections of the Monashee Mountains, at least as far north as the junction of Burrel Creek with the Granby River: the Columbia River acting as an effective barrier against movement to the east, within the Province. Westward, *fuscus* intergrades with *incensus* where their two ranges overlap in the southern Okanagan.

Thomomys talpoides incensus occupies the largest area of any race of pocket gopher in British Columbia. Shuswap, the type locality on the south side of the South Thompson River, approximately 50° - 48' N.,

marks the northern known limit of the genus west of the Rocky Mountains.

Westward, their range extends to Ashcroft, east of the Thompson River, then southward to Allison Pass in Manning Park.

Thomomys talpoides segregatus, a new subspecies, is known only from material collected at Creston and the type locality at Wynndel, a small area, east of the Kootenay River, on the bench lands of Goat Mountain.

Thomomys talpoides cognatus, a new subspecies, occupies an area east of the Kootenay River in the south-east corner of British Columbia. Large populations inhabit the park-like plateau between the Kootenay River and the Rocky Mountains. The locality from which the type specimen was collected is within a few miles of the Alberta boundary, in the Crowsnest Pass, and marks the northern limit of their range.

ACCOUNTS OF SUBSPECIES

GENUS THOMOMYS WIED.

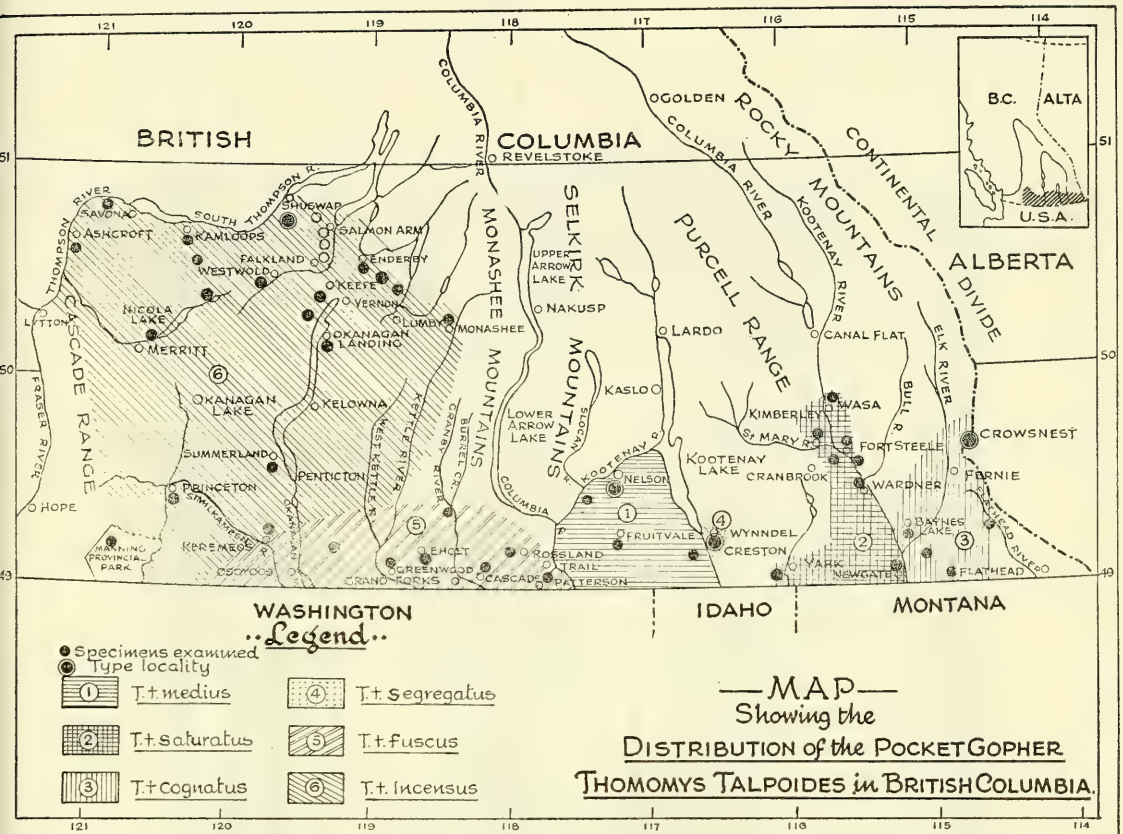
THOMOMYS TALPOIDES MEDIUS Goldman. Kootenay Lake Pocket Gopher. 1939. *Thomomys talpoides medius* Goldman. Journ. Mamm., vol. 20, No. 2, p. 241, (May 14th, 1939).

TYPE LOCALITY. Silver King mine, summit of Toad Mountain, six miles south of Nelson, British Columbia. (Type; U. S. N. M. No. 66653).

RANGE in BRITISH COLUMBIA. North from the International Boundary; on the east to the Kootenay River; north to Kootenay Lake, and westward to the Kootenay and Columbia rivers to Waneta on the east side of the Columbia River.

DESCRIPTION. Size small; skull slender. Similar in general to *fuscus* but color darker, and different in well marked cranial characteristics.

COLOR. Summer pelage, above Brussel's Brown to Hazel, brightest on head, fading on sides and thighs to Sayal Brown or Cinnamon; ears small and slightly pointed; auricular patches sooty and extending but little posterior to the ears; underparts Dark Mouse Gray, thinly washed or overlaid with Cinnamon; small white patch on the chin variable; front legs brownish to toes which are white; hind feet dull white; tail dull whitish, basal half darker.



SKULL. Slender with smoothly rounded braincase; frontals depressed anteriorly, straighter, therefore less convex in profile; temporal ridges weakly defined and converging anteriorly, not constricted at frontoparietal suture; nasals not constricted medially and emarginate posteriorly; the ascending tongues of the premaxillae extending well posterior to the nasals; interparietal extends little if any posterior to the sutures joining the supraoccipital with the two parietals; supraoccipital bone takes part in forming the roof of the cranium; basioccipital not constricted medially; pterygoids divergent posteriorly, with anterior angle obtuse; foramen magnum as high as wide; rostrum narrow and constricted immediately in front of zygomata; palate projecting posteriorly behind the anterior plane of posterior molars.

SPECIMENS EXAMINED. 28, as follows: Toad Mountain, (topotypes), 2; West Creston, 15; Fruitvale, 9; Hall Creek, 2.

THOMOMYS TALPOIDES SATURATUS Bailey. Coeur D'Alene Pocket Gopher. 1914. *Thomomys fuscus saturatus* Bailey, Proc. Biol.

Soc. Wash., Vol. 27, pp. 117, (July 16th, 1914). 1939 *Thomomys talpoides saturatus* Goldman, Journ. Mamm., vol. 20, p. 234, (May 14th, 1939).

TYPE LOCALITY. Silver, near Saltese, Coeur d'Alene Mountains, Missoula county, (now Mineral county), Montana. (Type; U. S. N. M. No. 22781/40885).

RANGE IN BRITISH COLUMBIA. Southern parts of the Selkirk Mountains in south-eastern British Columbia near the International Boundary. In the Moyie River valley, on the west side of the Moyie River, as far north as Yahk. In the Kootenay River valley, on the west side of this river to Wardner, and then on both sides of the river as far north as Wasa.

DESCRIPTION. Larger than *fuscus*, with which it intergrades, and with darker, richer coloration and less tendency to white markings below.

COLOR. Summer pelage, above Sudan Brown to Hazel, fading on sides and thighs to Drab Gray. Ears small, slightly pointed

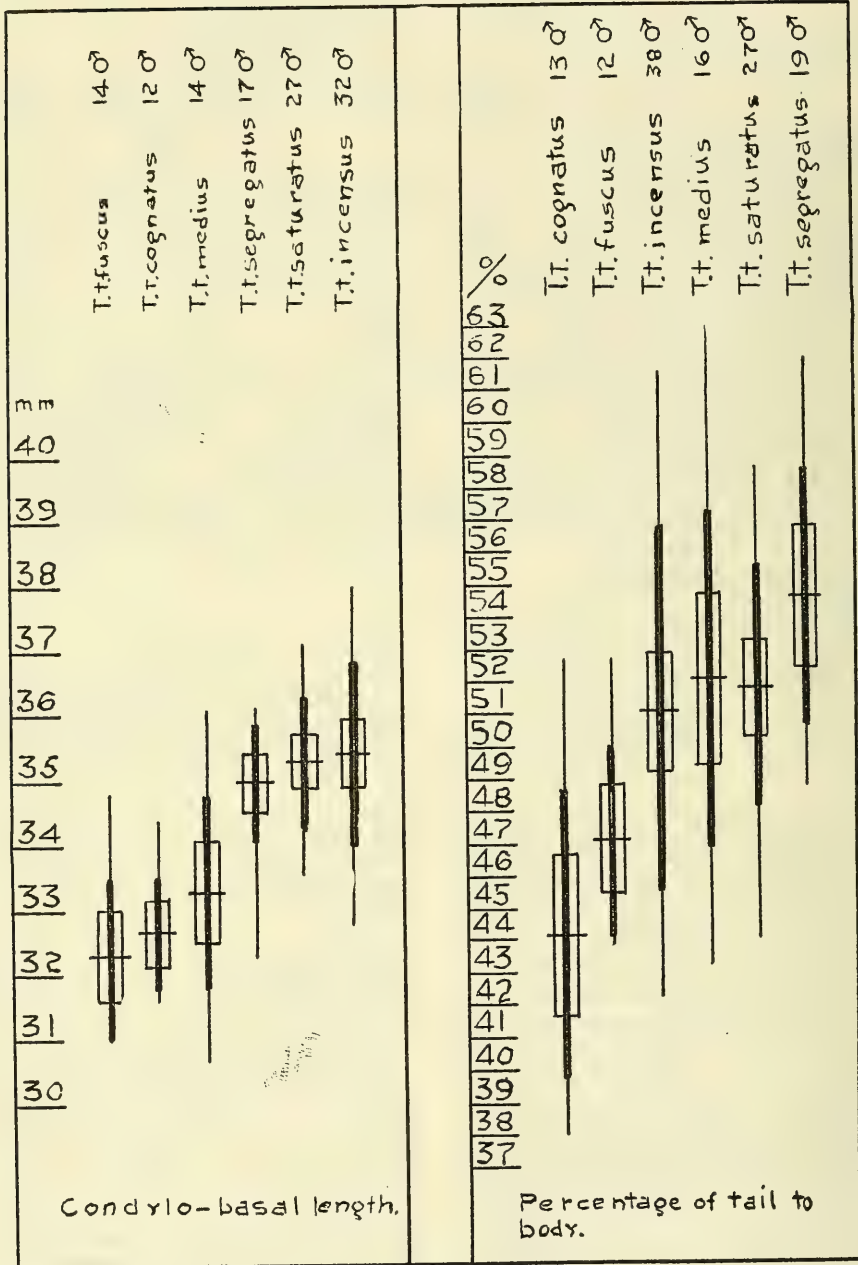


Fig. 1. Statistical analysis of samples of *Thomomys talpoides* from British Columbia. Vertical lines represent range; crossbars indicate means. The heavy line is one standard deviation above and below the mean. The rectangles are two times the standard error on each side of the mean. In general, if the positions of the rectangles do not overlap, statistically significant differences exist. In computing S. D. N-1 was used.



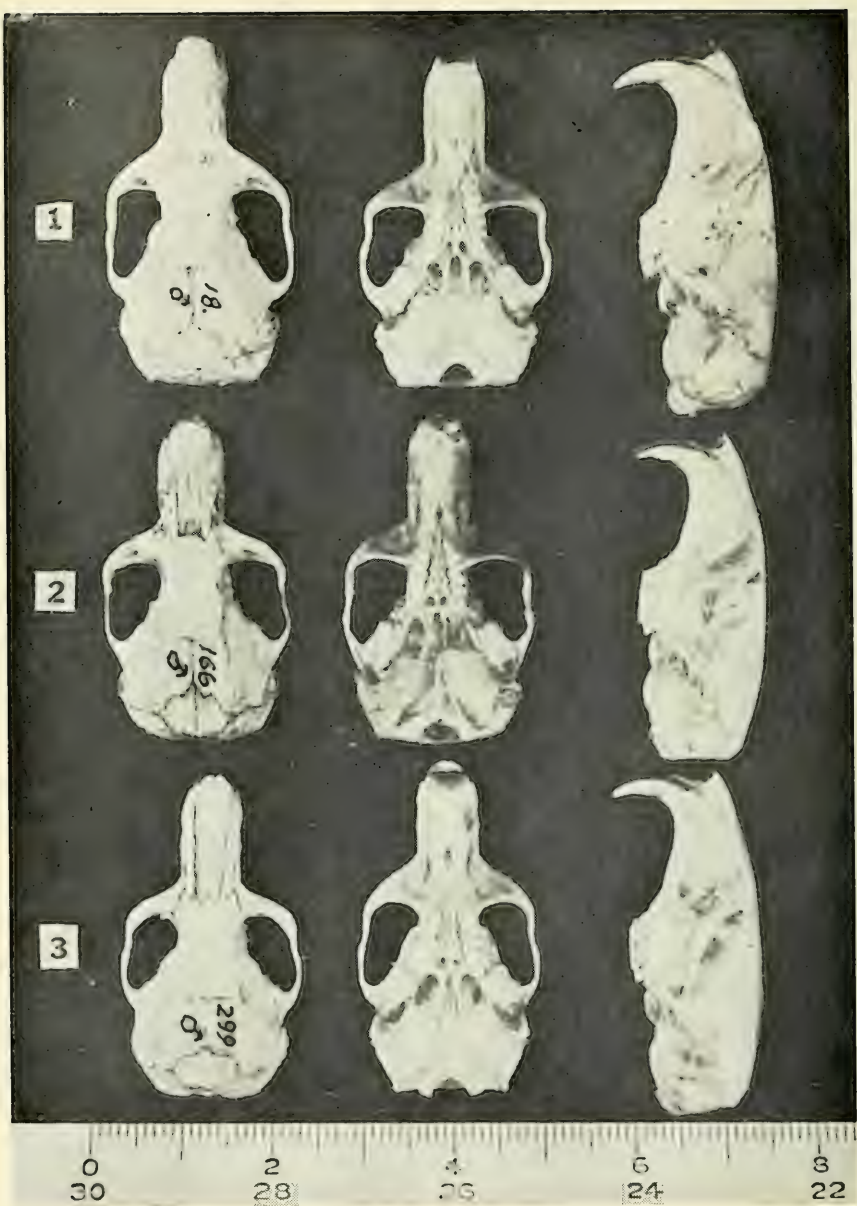


Plate 2. Skulls of pocket gopher, *Thomomys talpoides*. 1. *T. t. saturatus*. 2. *T. t. cognatus*. 3. *T. t. segregatus*.

Table 1. BODY MEASUREMENTS OF *THOMOMYS TALPOIDES* FROM BRITISH COLUMBIA.

Subspecies	No. of Males Examined	Mean		Mean		Mean	
		Total Length		Tail Length		Hind Foot Length	
		± S.E.		± S.E.		± S.E.	
		mm.		mm.		mm.	
<i>T. t. saturatus</i>	31	209.1	1.62	70.9	1.12	27.4	0.26
<i>T. t. segregatus</i>	19	207.6	1.65	73.4	0.97	26.9	0.33
<i>T. t. incensus</i>	31	203.3	1.33	64.5	1.33	25.7	0.15
<i>T. t. medius</i>	14	199.2	1.89	67.5	1.70	25.1	0.36
<i>T. t. fuscus</i>	16	193.2	1.80	62.1	0.70	25.3	0.24
<i>T. t. cognatus</i>	13	188.9	1.75	57.8	1.17	25.8	0.25

and narrowly encircled with black. Underparts Deep Mouse Gray, thinly washed with Drab Gray, the small amount of white on the chin variable. Front legs brownish to toes which are white; small amount of white on under surface of front legs. Tail, basal half Mouse Gray, then white to tip, line of demarkation distinct; hind feet dull white.

SKULL. Long and narrow with high truncate occiput; temporal ridges well defined and converging but slightly anteriorly and not constricted at the frontal-parietal suture; nasals widened anteriorly and roundly truncate posteriorly; premaxillae narrow posteriorly and extending but little behind the nasals; interparietal roughly ovoid and projecting posterior to the suture joining the supraoccipital with the two parietals; supraoccipital takes part in forming the roof of the cranium; basioccipital constricted medially; anterior angle of the pterygoids obtuse and divergent posteriorly, leaving a wide space between them; foramen magnum higher than wide; rostrum narrow, averaging less than the width of the least interorbital constriction; posterior border of the palate relatively narrow.

SPECIMENS EXAMINED. 82, as follows: Saltese 6, (topotypes); West Newgate, (Linklater Creek), 8; Wardner, 7; Turtle Lake, 8; St. Mary's Prairie, 10; Bull River, 5; Fort Steele, 9; Wasa, 18; Yahk, 11.

THOMOMYS TALPOIDES FUSCUS (Merriam). Brown Pocket Gopher. 1891. *Thomomys clusius fuscus* Merriam, North Amer. Fauna. No. 5, p. 70 (July 30th, 1891).

1901 *Thomomys talpoides fuscus* Merriam, Proc. Biol. Soc. Wash., vol. 14, p. 111 (July 19th, 1901).

TYPE LOCALITY. Mountains at the head of Big Lost River, Custer county, Idaho. (Type: U. S. N. M., No. 24267/31671.)

RANGE IN BRITISH COLUMBIA. Southern parts of the Monashee Mountains, near the International Boundary; east to the Columbia River; west to the southern Okanagan, where they intergrade with *incensus*, and north at least as far as the junction of Burrel Creek with the Granby River.

DESCRIPTION. Size small; skull relatively slender with large bullae; ears small and distinctly pointed.

COLOR. Summer pelage, above Ochraceous Tawny to Chesnut; fading on sides and thighs to Buffy Brown; nose Plumbeous; ears narrowly encircled with black. Underparts Mouse Gray overlaid with buffy; white spot on chin variable; front and hind legs pale buffy; feet dull white; tail dull white, basal half gray.

SKULL. Light and slender with swollen occipital region; temporal ridges well defined and converging anteriorly, not constricted at the suture joining frontal with the parietals; nasals posteriorly roundly truncate and narrow, not constricted medially; premaxillae tongues extending posteriorly beyond the nasals; interparietal roughly ovoid and projecting some distance posterior to the sutures joining supraoccipital with the two parietals; supraoccipital takes part in forming the roof of the cranium; basioccipital constricted medially; pterygoids long and narrowly V-shaped with the anterior angle acute; foramen magnum higher than wide and slightly octagonal; rostrum relatively narrow but averaging wider than the width of least interorbital constriction; posterior border of palate relatively narrow.

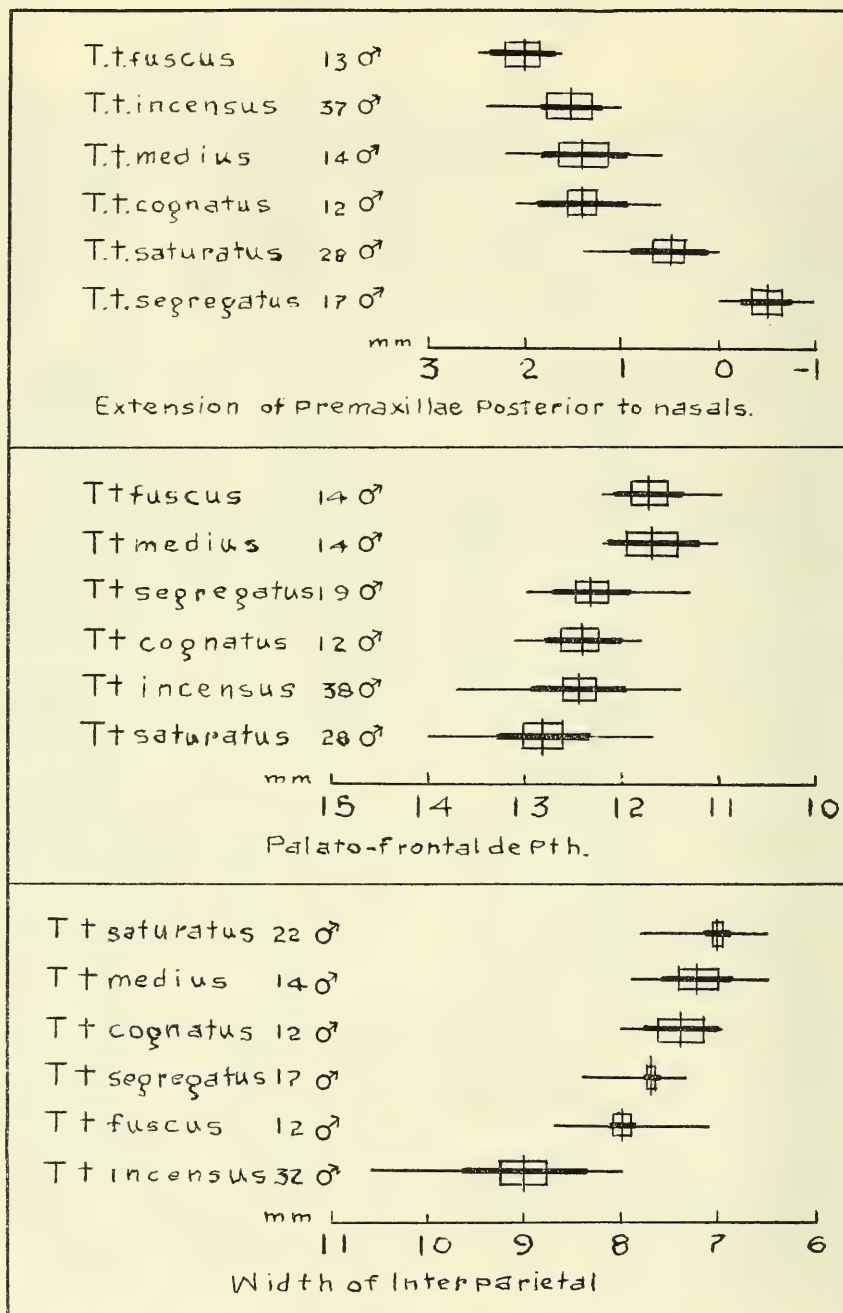


Fig. 2. Statistical analysis of samples of *Thomomys talpoides* from British Columbia. Horizontal lines represent range; crossbars indicate means. The heavy line is one standard deviation above and below the mean. The rectangles are two times the standard error on each side of the mean. In general, if the positions of the rectangles do not overlap, statistically significant differences exist. In computing S. D. N-1 was used.

SPECIMENS EXAMINED. 37, as follows, Big Lost River, 8, (topotypes); Rossland, 14; Sheep Creek, 7; Eholt, 6; Cascade, 2.

THOMOMYS TALPOIDES INCENSUS Goldman. Shuswap Pocket Gopher. 1938 *Thomomys talpoides incensus* Goldman, Journ. Mamm., vol. 20, No. 2, pp. 240 — 241 (May 14th, 1938).

TYPE LOCALITY. Shuswap, Yale District, British Columbia, (Type; U. S. N. M., No. 67096).

RANGE IN BRITISH COLUMBIA. Thompson River Valley, and South Thompson River, these two streams marking the northern extension of the range. East to the Monashee Mountains, near the head waters of the Kettle River and to the Okanagan Valley south of Penticton, where there is intergradation with *fuscus*. West to the summit of the Cascade Range, in Manning Provincial Park.

DESCRIPTION. Closely allied to *fuscus*, but cranial characters different in important details; the palatal shelves are narrower and more excised, the interpterygoid fossae narrower, and notably the much wider interparietal.

COLOR. Summer pelage, above Mikado Brown to Cinnamon, fading on sides and forearms to Cinnamon Buff or Pinkish Buff. Ears slightly pointed and narrowly encircled with black. Underparts, Slate Gray, overlaid with Pinkish Buff; rarely a small white spot on chin or chest; front legs Pale Mouse Gray to toes which are dull white; small amount of white on undersides of front legs; hind legs Pale Mouse Gray to toes which are dull white. Tail, basal half brownish, paling to white at the tip. Considerable melanism occurs in colonies at O'Keefe and Lavington, and an adult male collected at Grinrod is entirely black.

SKULL. Similar in general to *fuscus*, but larger and with braincase broader; temporal ridges well defined and converging anteriorly, definitely constricted at the frontoparietal suture; nasals roundly emarginate posteriorly and slightly constricted medially; ascending tongues of the maxillae extending well posterior to the ends of the nasals. Interparietal extended transversely, outstanding, averaging 1.5 mm. wider than in *fuscus*, and projecting little if any posterior to the sutures joining the supraoccipital with the two parietals; supraoccipital takes part in forming the roof of the cranium; basioccipital

long, wide and constricted medially; pterygoids long with the space between them relatively narrow; foramen magnum higher than wide; posterior border of palatal shelves narrow, more excised between posterior molars.

SPECIMENS EXAMINED. 195, as follows, Shuswap 9, (topotypes); Falkland, 11; Grinrod, 7; Salmon Arm, 6; Ashcroft, 8; Savona, 4; Manning Park, 28; Princeton, 4; Keremeos, 1; O'Keefe, 11; Monashee, 6; Silver Star Mountain, 1; Stump Lake, 6; Bolean Lake, 3; Enderby, 4; Lavington, 13; Six Mile Creek, 4; Okanagan Landing, 25; Summerland, 3; Bridesville, 12; Greenwood, 6; Kamloops, 13; Tunkwa Lake, 10.

THOMOMYS TALPOIDES SEGREGATUS. Wynndel Pocket Gopher. New subspecies.

TYPE LOCALITY. Goat Mountain, on the east side of the Kootenay River, near Wynndel, British Columbia. (Type; adult male, skin and skull. Original number 299; Provincial Museum, Victoria, British Columbia.)

RANGE IN BRITISH COLUMBIA. Known only from the type locality and Creston, British Columbia.

DESCRIPTION. Size medium, tail long; skull slender; tympanic bullae inflated anterolaterally; premaxillae tongues not extending past the posterior ends of the nasals.

COLOR. Summer pelage, above Brussels Brown to Argus Brown, fading to Drab Gray on sides; nose Plumbeous; ears inconspicuously encircled with sooty. Underparts, Dark Plumbeous. Occasionally varying amounts of white on chin and ventral surface. Front legs Plumbeous to toes which are white; under parts of front legs white; hind feet dull white. Tail dull white to base which is Mouse Gray.

SKULL. Slender with anterolaterally inflated tympanic bullae; temporal ridges poorly defined, converging anteriorly and not constricted at frontoparietal suture; nasals posteriorly emarginate, relatively wide and not constricted medially; premaxillae tongues scarcely reaching to the posterior ends of the nasals; interparietal with pronounced anterior angle and projecting posteriorly well past the sutures joining supraoccipital with the two parietals; the supraoccipital is truncate and takes part in forming the roof of the cranium; basioccipital wide and not constricted medially; pterygoids long and narrowly V-

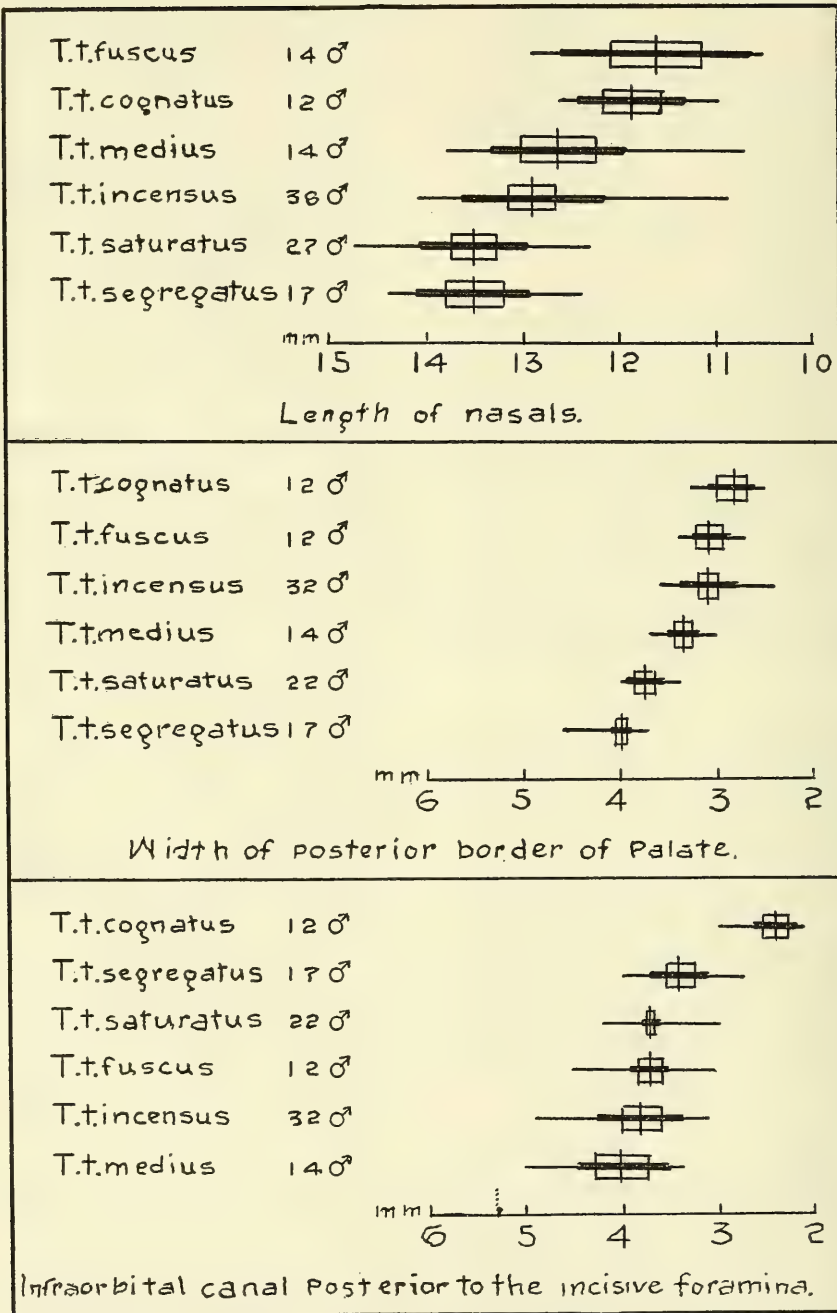


Fig. 3. Statistical analysis of samples of *Thomomys talpoides* from British Columbia. Horizontal lines represent range; crossbars indicate means. The heavy line is one standard deviation above and below the mean. The rectangles are two times the standard error on each side of the mean. In general, if the positions of the rectangles do not overlap, statistically significant differences exist. In computing S. D. N-1 was used.

shaped; foramen magnum higher than wide, octagonal rather than round.

COMPARISON. Selected differences in *segregatus* as compared to *saturatus*, the next adjacent race on the east, are as follows; dorsal coloration less Hazel: Ventral surface, Plumbeous rather than Deep Mouse Gray, with no buffy wash and therefore darker in appearance. Tail averages longer.

Selected cranial characters in which *segregatus* differs from *saturatus* are as follows; tympanic bullae more inflated anterolaterally; ascending tongues of premaxillae scarcely reaching the posterior ends of the nasals, distinctive; nasals emarginate rather than truncate; foramen magnum distinctly octagonal rather than round.

In comparison with *medius*, the next adjacent race to the west, selected cranial differences with *segregatus* are as follows, skull generally less slender; tympanic bullae more inflated anterolaterally; ascending tongues of premaxillae scarcely reaching the posterior ends of nasals, distinctive. Frontals not depressed as in *medius*, therefore more convex in profile and with greater palato-frontal depth. Posterior end of interparietal extending well past sutures joining parietals with supraoccipital, rather than in line with the sutures as in *medius*; pterygoids less divergent and therefore with less space between them; zygomatic arches with pronounced outward bulge in posterior half, rather than rounded as in *medius*.

SPECIMENS EXAMINED. 48, as follows, 44 from the type locality at Wynndel; Creston 4.

THOMOMYS TALPOIDES COGNATUS. Crowsnest Pocket Gopher. New subspecies.

TYPE LOCALITY. Crowsnest Pass, British Columbia. (Type; adult female, skin and skull. Original number 281; Provincial Museum, Victoria, British Columbia.)

RANGE IN BRITISH COLUMBIA. North from the Montana boundary on the east side of the Kootenay River at Newgate to Baynes Lake, then north east to Crowsnest Pass, on the Alberta inter-provincial boundary.

DESCRIPTION. Size small, tail short. Ears small and rounded. Skull relatively slender with inflated bullae.

COLOR. Summer pelage, above Sayal Brown to Snuff Brown, fading to Cinnamon Buff on sides and thighs. Auricular patches black, conspicuous, and extending well post-

erior to the ears; nose Snuff Brown. Underparts Dark Plumbeous, thinly washed or overlaid with Pale Cinnamon; occasionally large patches of white occur on ventral surfaces with a white streak extending over the nose as far posteriorly as the ears. Front legs, Light Mouse Gray to toes which are dull white, Hind feet dull white. Tail, Drab Gray for almost entire length except extreme tip which is dull white.

SKULL. Light and slender with mastoidal bullae inflated and well exposed. Temporal ridges well defined and converging anteriorly but not constricted at the frontoparietal suture; nasals posteriorly truncate and narrow, not constricted medially; premaxillae tongues extending well posteriorly behind the nasals; interparietal roughly ovoid with pronounced anterior angle; the interparietal is distinct in as much as it projects so far posterior to the sutures joining the supraoccipital with the two parietals, as to meet the ascending vertical plane of the supraoccipital, which is truncate and takes little part in forming the roof of the cranium. Basioccipital narrow and constricted medially; pterygoids short and narrowly V-shaped; foramen magnum round, slightly higher than wide; rostrum comparatively short and averages wider than the least interorbital constriction.

COMPARISON. Selected differences in *cognatus* as compared with *saturatus*, the next adjacent race on the west, are as follows; smaller size, shorter tail. Dorsal coloration paler; tail without dark basal half and distinct line of color demarkation. More tendency to white markings below, some totypes of *cognatus* have 24% of the ventral surface of the body white. Selected cranial characteristics, in which *cognatus* differs from *saturatus*, are as follows; mastoidal bullae more globular and exposed; the anterior angle of the interparietal more pronounced; the posterior projection of the interparietal is distinct. Also distinctive is the position of the juncture of the maxillae and premaxillae in the anterior part of the cavity of the mouth, as it is so far posteriorly situated as to place the incisive foramina less anterior to the infraorbital canal than in *saturatus*. The basioccipital is narrower, more constricted medially and more Y-shaped. Premaxillae tongues extend further behind nasals.

SPECIMENS EXAMINED. 29, as follows, Crowsnest (type locality), 10; Baynes Lake, 10; East Newgate, 9.

SUMMARY

Only adult males were used for the purpose of the statistical analyses; this was considered advisable for better conformity, and to avoid the definite trend toward sexual dimorphism that was observed during the investigation.

A total of four hundred and eighty pocket gophers was collected from all the accessible areas throughout their range in British Columbia; of this number the sex ratio was two hundred and twenty-two males to two hundred and fifty-eight females.

In order to minimize the possibility of error, and to arrive at an accurate determination of the subspecies *T. t. fuscus* and *T. t. saturatus*, all material was critically compared with topotype specimens of the two races named; this established the fact that populations designated with these names, conformed to the characteristics of the topotypes.

Ridgway's Color Standards and Color Nomenclature was used in describing body coloration. The technique employed in obtaining the length of tail was to measure the caudal vertebrae after the skin had been removed.

Two new subspecies have been described, and it has been demonstrated that the range of these two subspecies is geographically logical. The existence of natural barriers has prevented overlapping, and hence interbreeding, between these two races and the different subspecies, that are their immediate neighbours.

The new subspecies *Thomomys talpoides cognatus*, has its range in an area east of the southward flowing Kootenay River, in the south-east corner of the Province. This pocket gopher is readily distinguishable by several consistent characteristics; dorsal coloration decidedly Snuff Brown instead of Hazel; a greater amount of white on the ventral surface; small size and proportionally short tail. Cranial characteristics which are unique are the shape and posteriorly projecting position of the interparietal, and the posteriorly situated incisive foramina.

The new subspecies *Thomomys talpoides segregatus*, is known only from several populations on the slopes of Goat Mountain, between Wynndel and Creston in the Kootenays. The lack of any buffy wash or overlay on the underparts, giving the ventral surface a decidedly dark appearance is diagnostic; the dorsal coloration is Argus Brown rather than Hazel; the tail is comparatively long, with

little or no distinct line of demarkation between the gray base and whitish tip. Outstanding cranial characteristics are the ascending premaxillae tongues, that scarcely reach the posterior ends of the nasals; the anteriorly inflated tympanic bullae, and the pronounced outward bulge in the posterior half of the zygomatic arches.

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RANGE EXTENSIONS OF AMPHIBIANS IN EASTERN CANADA¹

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RELATIVELY little is known of the distribution of amphibians and reptiles in Canada. At present only one hundred species and subspecies are recognized. Most are common to several provinces. However, less than a dozen specimens of many species have ever been collected and these often are left unreported, or as in some cases, there may be no collections of species common throughout a province. For thirty-five amphibians and reptiles found east of Ontario, the distributional descriptions and maps in texts printed in the United States are incorrect in twenty-nine cases, and often by several hundred miles. R. C. Mills (1948) and E. B. S. Logier (1952) have contributed the most recent regional summaries for Canada. This paper is confined to a summary of range extensions of amphibians in eastern Canada. The corrections and extensions of ranges apply to the works of Wright and Wright (1949), Mills (1948), Bishop (1943) and in some instances to Logier (1952).

The province of Prince Edward Island is a region which is seldom mentioned by Mills, Wright and Wright or Bishop. In addition, on most distribution maps it is difficult to determine whether the island is meant to be included in a range or not. A National Museum of Canada expedition in 1953 found the Common Toad (*Bufo terrestris americanus*), Spring Peeper (*Hyla crucifer crucifer*) Leopard Frog (*R. pipiens*), Green Frog (*R. clamitans*), and Wood Frog (*R. sylvatica*) to be common in this province. The Mink (*R. septentrionalis*), Bull (*R. catesbeiana*) and Pickerel (*R. palustris*) Frogs were found in New Brunswick and Nova Scotia but not on Prince Edward Island, and only one report of the Pickerel Frog on the island, Hurst 1944, is known to the writer. Except for the Newt (*Triturus viridescens viridescens*) which is common in nearly every mill pond throughout the island, few specimens of salamanders have been collected although the Spotted (*Ambystoma maculatum*), Jefferson's (*A. jeffersonianum*) and Red-backed (*Plethodon cinereus cinereus*) Salamanders are known to occur there.

The species are discussed in order of their appearance on the accompanying lists of records (Tables 1 and 2). The relative abundance of a species in any one locality will be mentioned where the information is available. Unless otherwise stated, identification is based on adult specimens. If the reader has neither Wright and Wright, Mills or Bishop then the location of the range limits previous to this paper can be determined by working backwards with the extension mileages given with each species.

SALIENTIA

Bufo terrestris copei — Cope's Toad. The range is extended approximately 200 miles to the east and 300 miles to the north. In 1951 and 1952 toads were observed to be abundant during their spring spawning season at Sept Iles, Mile 134 and Menihék Lake. The writer has seen photographs of toads collected at Knob Lake.

Pseudacris nigrita triseriata — Swamp Cricket Frog. The range is extended approximately 100 miles east to Philipsburg and 70 miles north to Ottawa. Patch listed this species for Ottawa as early as 1918.

Hyla versicolor versicolor — Common Tree Frog. The species is common in the Gatineau Valley region, a range extension of 50 miles northwards. In New Brunswick the first two specimens were collected at the Nashwaak River near Fredericton in 1935. These are Royal Ontario Museum of Zoology and Palaeontology specimens and reported here for the first time. During the summer of 1953 five specimens were taken from a chorus of about a dozen males near Fredericton, but no calls were heard in the other parts of the provinces that were visited. In 1898, Cox reported seeing "only one specimen, collected in Gloucester County" which is 100 miles northeast of Fredericton. In the future this species may be found to be common locally in sections of the Maritime Provinces but at the present time it must be considered as rare. The nearest previous collecting records are 200 miles away in southern Quebec and southern Maine.

Hyla crucifer crucifer — Spring Peeper. The range is extended eastward from New Bruns-

1) Received for publication February 26, 1954.

Table 1. RANGE EXTENSION RECORDS OF SALIENTIA

No.	Species	Locality	Year	Source
1.	<i>Bufo terrestris copei</i>	Salmon Bay, P.Q.	1866	*Packard, A.S.
2.	" " "	North West R., Lab.	1921	N.M.
3.	" " "	Menihék L., Lab.	1951	N.M.
4.	" " "	Knob Lake, P.Q.	1953	P.C.
5.	" " "	Mile 134, P.Q.	1952	N.M.
6.	<i>Pseudacris nigrita triseriata</i>	Ottawa, Ont.	1905-1953	N.M.
7.	" " "	Philipsburg, P.Q.	1953	N.M.
8.	<i>Hyla versicolor versicolor</i>	Danford L., P.Q.	1941	N.M.
9.	" " "	Nashwaak River, N.B.	1935	R.O.M.Z.
10.	" " "	Fredericton, N.B.	1953	N.M.
11.	<i>Hyla crucifer crucifer</i>	Nova Scotia & P.E.I.	1935-1953	N.M., N.S.M.S. & R.O.M.Z.P.
12.	" " "	Sept Iles, P.Q.	1952	N.M.
13.	" " "	Menihék L., Lab.	1952	P.C.
14.	<i>Rana clamitans</i>	Terra Nova, Newf.	1950	R.O.M.Z.P.
15.	" " "	Avalon Pen., Newf.	1922	*N.M. & R.O.M.Z.P.
16.	" " "	Sept Iles, P.Q.	1952	N.M.
17.	<i>Rana pipiens</i>	Grand R., Lab.	1921	*N.M., Kindle
18.	" " "	Anticosti Isl.	1923	*N.M.
19.	<i>Rana septentrionalis</i>	Anticosti Isl.	1953	N.M.
20.	" " "	Sept Iles, P.Q.	1952	N.M.
21.	" " "	Mile 134, P.Q.	1952	N.M.
22.	" " "	Okak, Labrador	1866	*Packard, A.S.
23.	<i>Rana sylvatica cantabrigensis</i>	Richmond Gulf, P.Q.	1920	N.M.
24.	" " "	Knob Lake, P.Q.	1952	N.M.
25.	" " "	Ft. McKenzie, P.Q.	1952	N.M.
26.	" " "	Ft. Chimo, P.Q.	1948	*N.M.
27.	" " "	Natsitok, P.Q.	1931	*Hantzsch, B.
28.	" " "	George River, P.Q.	1949	*Hildebrand, H.

* records that have been published.

N.M. — National Museum of Canada, Ottawa, Ontario.

N.S.M.S. — Nova Scotia Museum of Science, Halifax, N.S.

R.O.M.Z.P. — Royal Ontario Museum of Zoology and Palaeontology, Toronto, Ontario.

P.C. — Personal communication.

wick into Nova Scotia and Prince Edward Island where it is abundant, and northwards to Sept Iles where the species is common. The only record north of Sept Iles is a description given to the writer by a naturalist-inclined M.D. student at Burnt Creek, Quebec, who had watched "tiny tree frogs with suction disc finger tips and huge vocal sacs" in a ditch one evening near Menihék Lake Camp. Admittedly such a record cannot be accessioned but is presented here to

indicate to future collectors the possibilities in Quebec and Labrador.

Rana clamitans — Green Frog. The range is extended north and eastwards to include the north shore of the Gulf of St. Lawrence. Green Frogs were found in numbers at Sept Iles. Wright and Wright (p. 451) depict the entire island of Newfoundland as containing this species whereas they have been found common only on the Avalon Peninsula. Out-

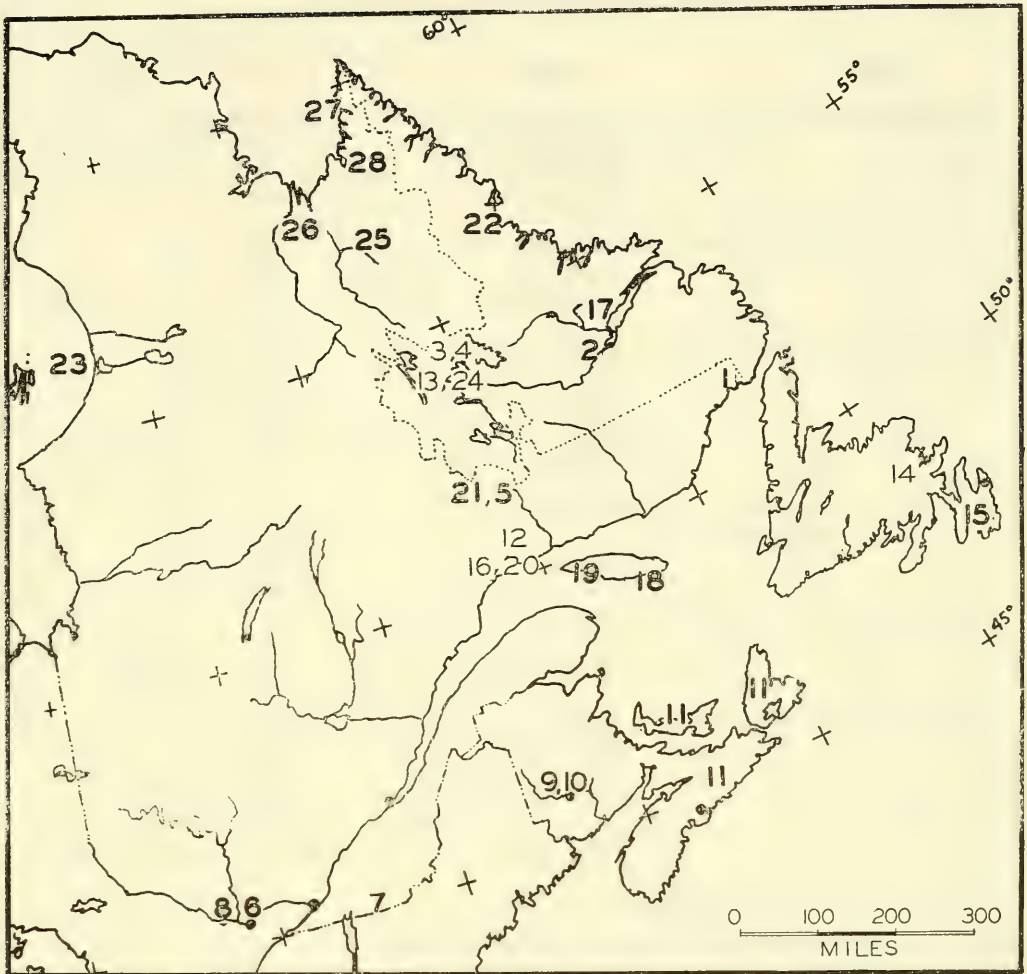


Fig. 1. Location of range extension records for *Sciantia*.

side of this region, there is only a specimen taken near Terra Nova in 1950.

Rana pipiens — Leopard Frog. The range is extended about 100 miles to the north. The National Museum has only this one specimen from Labrador. Wright and Wright (p. 481) exclude this species from Anticosti Island and include it in Newfoundland in spite of published records (Johansen, 1926) which point out that the reverse situation is true.

Rana septentrionalis — Mink Frog. The range is extended about 200 miles north to the Quebec-Labrador border. Mink Frogs were abundant in this region during their spring spawning season in 1952. If Packard's record at Okak is accepted (the specimen was identified by Cope) the range is extended past Wright and Wright's limits by

approximately 600 miles. The first specimen of this species from Anticosti Island was collected in 1953. Previous to 1953 there were only two published records of the Mink Frog from New Brunswick and but one reported specimen from Nova Scotia (Bleakney, 1952). The R.O.M.Z.P. has one specimen each from Halifax and Inverness Counties of Nova Scotia, reported here for the first time. However, during the summer of 1953 this species was found throughout both provinces including Cape Breton Island.

Rana sylvatica cantabrigensis — Wood Frog. The range is extended about 600 miles to the north. Adults were common at Knob Lake and at Fort McKenzie in 1952. In two ponds located near Fort Chimo tadpoles and

Table 2. RANGE EXTENSION RECORDS OF CAUDATA

No.	Species	Locality	Year	Source
1.	<i>Hemidactylium scutatum</i>	Gleneagle, P.Q.	1953	N.M.
2.	" "	Armdale, N.S.	1936	*N.S.M.S.
3.	" "	Mill Village, N.S.	1951	*N.S.M.S.
4.	" "	Baddeck, N.S.	1950	*C.M.
5.	<i>Eurycea bislineata bislineata</i>	Dalhousie, N.B.	1925	N.M.
6.	" " "	Scotch L., N.B.	1933	N.M.
7.	" " "	Browns Flats, N.B.	1953	N.M. & N.B.M.
8.	<i>Desmognathus fuscus fuscus</i>	Sherbrooke, P.Q.	1928	N.M.
9.	" " "	Knowlton, P.Q.	1946	N.M.
10.	" " "	Brome Co., P.Q.	1953	N.M.
11.	" " "	Browns Flats, N.B.	1953	N.M. & N.B.M.
12.	" " "	Fredericton, N.B.	1953	N.M.
13.	<i>Gyrinophilus porphyriticus porphyriticus</i>	Britannia, Ont.	1934	N.M.
14.	" "	Iron Hill, P.Q.	1946	*N.M.
15.	" "	Iron Hill, P.Q.	1953	N.M.
16.	<i>Plethodon cinereus cinereus</i>	Lake St. John, P.Q.	1938	*Trapido & Clausen
17.	" " "	Matamek R., P.Q.	1928	N.M.
18.	<i>Ambystoma jeffersonianum</i>	Goose Bay, Lab.	1948	N.M.
19.	" "	Belles Armours, P.Q.	1866	*Packard, A.S.
20.	" "	Betchewan, P.Q.	1931	C.U.
21.	" "	Sept Iles, P.Q.	1952	N.M.
22.	" "	Brakley Beach, P.E.I.	1946	*Hurst, B.
23.	" "	Nova Scotia	1935-1951	*N.M. & N.S.M.S.

* records that have been published.

N.M. — National Museum of Canada, Ottawa, Ontario.

N.S.M.S. — Nova Scotia Museum of Science, Halifax, N.S.

C.M. — Carnegie Museum, Pittsburgh, Pa.

C.U. — Cornell University, Ithaca, N.Y.

transforming frogs (August 22) were abundant but no adults were seen. In 1931, at Natsitok, Hantzsch heard "short squeaking and thrilling notes" and "saw very large tadpoles" but unfortunately he was not able to collect any specimens. The writer visited the east coast of Ungava Bay from Fort Chimo to Port Burwell in 1952 and questioned Eskimo families camped along this coast as well as the crew of the boat in which he was sailing. They knew of frogs only at Fort Chimo and George River (80 miles E.N.E. of Fort Chimo). To the writer's knowledge no frogs have ever been collected at the latter site (Hildebrand 1949). The northern limit of frogs as prescribed by the

Eskimo corresponds to the generally accepted limit of trees, that is along a line from Fort Chimo to George River. However, many tents along this coast north of George River were burning dwarf birch (*Betula glandulosa*) and the writer was informed that it was to be found just a short way inland, and that up many of the river valleys there were other larger trees. Taking into consideration these reports and that of Rousseau (report to the Arctic Institute of North America, Montreal, 1951) who found large conifers (*Picea mariana* and *Larix laricina*) and even a few mature paper birch (*Betula papyrifera*) in one of the deep valleys of Labrador near latitude 60° N., it is

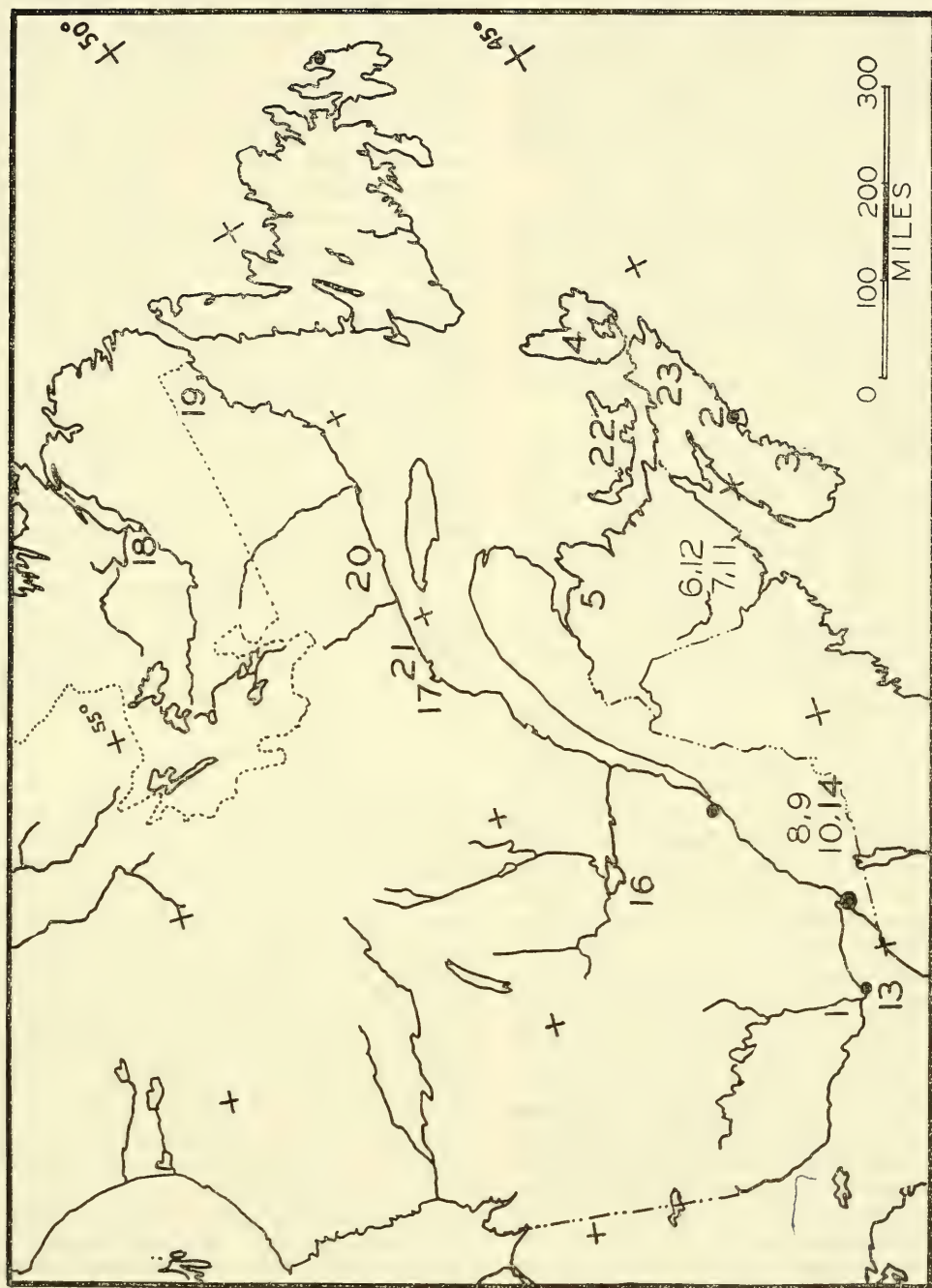


Fig. 2. Location of range extension records for Caudata.

not unlikely that relict populations of Wood Frogs exist in several valleys north of the arctic tree line.

CAUDATA

Hemidactylium scutatum — Four-toed Salamander. The range is extended from southern Maine 400 miles eastward into Nova Scotia. (See Bleakney 1952 for a discussion of these Nova Scotia records). The specimen from Quebec was taken 100 miles north of any previous records for this region.

Eurycea bislineata bislineata — Two-lined Salamander. This species is locally common in south, central and northern sections of New Brunswick. These records are presented here to substantiate and slightly extend Bishop's ranges for the province. The writer has attempted to find Two-lined salamanders in Nova Scotia but has been unsuccessful to date.

Desmognathus fuscus fuscus — Dusky Salamander. The range is extended 80 miles north into Brome County, Quebec, where this salamander is common in many of the streams. The species was found locally common in the lower St. John River Valley which is just at the eastern extreme of Bishop's limits. Collecting in Nova Scotia has had negative results with this species. *Gyrinophilus porphyriticus porphyriticus* — Purple Salamander. — Very few specimens have been collected in Canada although it appears to be common at Iron Hill, Quebec, a range extension of 50 miles. The Britannia record (near Ottawa) is based on a large transforming larva and extends the range 100 miles northwards. The writer has a verbal report of a "large red lizard" being caught and released near Edmundston, New Brunswick, in 1952.

Plethodon cinereus cinereus — Red-backed Salamander. The two records listed are the most northerly known in eastern Canada although Trapido and Clausen's report is south of Bishop's limits. The National Museum specimen is an extension of 100 miles northwards. In 1952 the writer questioned Indians from Moisie and Natashquan on the north shore of the Gulf of St. Lawrence and was told that small red salamanders are found in their woodpiles.

Ambystoma jeffersonianum — Jefferson's Salamander. The range is extended eastward from New Brunswick to include Prince Edward Island and Nova Scotia. Bishop is more inclusive in his map than in his written delineation of the range to the northeast.

However, so few specimens have been reported from the Quebec-Labrador area that those which are known are included here. The Sept Iles records are based on numerous egg-masses which the writer collected in a bog pond. No adults were found. The specimen from Goose Bay extends the range approximately 100 miles. Packard's description of "six inch long" and "dark slate color" and his use of the specific name "*glutinosa*" could very well apply to this species.

The accompanying lists (Tables 1 and 2) contain twenty-eight range extension records for Salientia and twenty-three records for Caudata. Several of these records have been published previously but were not included in the range maps in texts dealing with the amphibians. The year date refers to when the collection was made and does not necessarily correspond to the date of publication of that record. Where possible the record source refers to the present location of the specimen or specimens. The number beside each record corresponds to that on the distribution map. There are separate maps for the Salientia and the Caudata. These maps are included here to show the extent of this area which has had so little attention (an area nearly equal to that of the United States east of the Mississippi River) and to aid the reader in locating the sites of the records.

ACKNOWLEDGMENTS

The author is particularly indebted to his wife, and to Messrs. Stanley Gorham, Norris Denman and Francis Cook for their valuable field assistance and contributions of specimens, and also to Mr. E. B. S. Logier who kindly placed several unpublished records at the writer's disposal. In addition, field work done in Nova Scotia in 1950 was financed by the Nova Scotia Museum of Science, and a McGill Carnegie Arctic Scholarship made possible a summer of collecting in northern Quebec and Labrador in 1952.

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THE MAMMALS OF RENFREW COUNTY, ONTARIO¹

N. R. BROWN² and R. G. LANNING³

RENFREW COUNTY, an area in excess of 3,000 square miles, lies on the eastern border of Ontario, running from Arnprior in the south, past Stonecliff along the Ottawa River, and going approximately 60 miles west along its southern border.

The topography of the county varies from the level farm land in the south-east along the Ottawa River to the rough, broken hills of the western part. The area is marked by a number of lakes and rivers which shelter a large mammal population and which are an important factor in the economics of the region either directly, in hunting and trapping by the residents, or indirectly through the tourist trade. A map and careful description

of the area under consideration has already been published by Lloyd and Lanning (1948). The Petawawa Military Reserve, where most of Brown's observations were made, has previously been described and illustrated (Brown 1947).

Thanks are due to our many friends who so generously gave any information requested or who discussed the many problems and offered any possible assistance. Particularly we would like to thank the following for allowing us access to their records: Dr. H. B. Hitchcock — bat records from Craigmont and Fourth Chute; Mr. Hoyes Lloyd — field records from Golden Lake 1924-1945; Mr. Sheldon Davis — field records; Mr. A. T. Cringan — field records; Mr. R. Y. Edwards — field records; Mr. S. C. Downing and the Royal Ontario Museum of Zoology

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and Palaeontology for use of material in their files, particularly the records of the 1936 field party, and for some subspecific identification; Dr. A. L. Rand and Dr. R. M. Anderson, both formerly of the National Museum of Canada for critical examination of specimens forwarded for subspecific identification; the National Museum of Canada who allowed us access to their records through the courtesy of the late Mr. Clyde Patch.

Thanks are also due to the Department of Lands and Forests of Ontario whose officers gave assistance whenever possible, and to Mr. H. G. Lumsden, District Biologist of Quinte District, who critically read much of the manuscript and contributed to our knowledge of fur and game conditions in the southern part of Renfrew County which adjoins the Quinte District.

Brown's trapping was done in the summers of 1940, 1941 and 1942 and notes were made on 679 individuals trapped as part of a forest insect study while in the employ of the Division of Entomology, Canada Department of Agriculture. Three hundred and twenty-one skins of 22 species were preserved.

Lanning's trapping was done in the summers of 1943 and 1944 and notes were made on 64 specimens of 14 species. In addition Lanning spent the summers from 1940 to 1944 at Combermere and revisited Renfrew County in October 1946 and in February and October 1948. After 1949 a number of one-day trips were made by Lanning from Belleville to the southern part of Renfrew County.

Forty-five species are included in the following list, of which 24 are substantiated with specimens. Nomenclature and arrangement is that of Anderson (1946). Measurements are in millimetres. L. is the total length from snout to the end of the tail vertebrae, T. is the length of the tail, and H.F. is the length of the hind foot from the heel to the tip of the longest claw.

ANNOTATED LIST OF MAMMALS

1. *Condylura cristata cristata* (Linnaeus)

STAR-NOSED MOLE. Occasionally reported from Combermere. The Royal Ontario Museum of Zoology field party found this species common at Golden Lake in July 1936. Two specimens were taken at Petawawa.

Four adult males averaged L., 186; T., 79; H.F., 28, with extremes being L., 195-181; T.,

81-76; H.F., 28-27. These measurements are within the range of sizes given by Burt (1946) but both tail and hind foot average measurements are considerably greater than those given by Hamilton (1943).

2. *Sorex cinereus cinereus* Kerr

COMMON CINEREOUS SHREW. Probably the commonest mammal of the area under consideration, particularly in the larch swamps. Brown's records show that 130 were taken in 1940, 190 in 1941 and 23 in 1942. This would seem to indicate a possible cyclic peak in the area in 1941 and these findings were corroborated by Edwards at Bark Lake.

Although larch swamps would appear to be one of the favoured habitats, this species was occasionally found in red pine plantations or scavenging about the garbage pits which were well away from cover. One specimen was taken at Bark Lake by Edwards during the day.

The average for 232 male specimens was L., 101; T., 41.5; H.F., 11; weight (127 specimens) 3.68 grams, with extremes being L., 114-90; T., 47-36; H.F., 13-11. Forty-six females averaged L., 101; T., 41; H.F. 11; weight (15 specimens) 4.05 grams. It is of interest to note that the ratio of males to females in the specimens taken was almost five to one.

3. *Sorex fumeus fumeus* Miller

SMOKY SHREW. Extensive trapping by Brown at the Petawawa Military Reserve revealed that this species was a fairly common resident of the larch swamps. It was also secured at Combermere.

Twenty-nine specimens averaged L., 114; T., 46; H.F., 13; weight (13 specimens) 5.74 grams, with extremes being L., 123-109; T., 51-42; H.F., 14-12. Measurements for males and females showed no significant variation and were therefore averaged together. The ratio of males to females taken was 6.25 to one.

4. *Sorex palustris albibarbis* (Cope)

WHITE-LIPPED WATER SHREW. Brown trapped this elusive species five times at Petawawa in the larch swamps and Lanning took one at Combermere by a small spring-fed pool in a wet deciduous woods.

It is of especial interest to note that this latter specimen was taken several yards away from the water in the center of an

old decayed log and that, although there were many spring-fed wet spots in the woods they were all of very limited size, not more than several yards in area, and on the whole not joined together.

All specimens taken were males and averaged L., 153; T., 70; H.F., 20; weight 12 grams.

5. *Microsorex hoyi intervectus* Jackson

NORTHERN PIGMY SHREW. Brown trapped this species quite regularly although he never found it common, one being taken in 1940 and 12 in 1941. Lloyd took a specimen at Golden Lake in 1929 which was assigned to this species by Dr. R. M. Anderson of Ottawa. All specimens taken were male and averaged L., 89.5; T., 31; H.F., 9; weight 2.76 grams, with extremes of L., 95-82; T., 34-30; H.F., 10-9; weight 3.10-2.50 grams.

It is of interest to note that of 409 shrews taken in our trapping only 64 were females, or only about 15 per cent. This percentage is possibly influenced by the fact that all trapping was done during the summer.

6. *Blarina brevicauda talpoides* (Gapper)

GAPPER'S SHORT-TAILED SHREW. Brown found this to be one of the commonest mammals of the damp larch swamps but also recorded it from dry hardwood localities. He also took four specimens from a red pine plantation on the Petawawa Military Reserve in 1940.

Edwards found this shrew common at Bark Lake but it was outnumbered in his records by the Cinereous Shrew in 1941.

Lanning found this species very common, perhaps the commonest mammal encountered, and it was trapped in all habitats and at all times of the day and night. Taking specimens during the day was quite a regular occurrence.

Measurements of males and females showed no significant variation when averaged separately and they are therefore combined; 64 specimens averaged L., 121; T., 27; H.F., 15; weight (43 specimens) 16.7 grams. Extremes were L., 134-110; T., 33-24; H.F., 20 (next highest 16)-14.

BATS

The following information, referring to all but the Silver-haired Bat, should be considered before the species are discussed individually.

Most of our information and material comes from the caves at Fourth Chute which

were visited several times by Dr. H. B. Hitchcock, accompanied by various persons including, at different times, Dr. A. L. Rand and Brown. The other important source of material is the Craigmont corundum mine which was visited by Mr. V. L. Eardley-Wilmot, Lanning, and Hitchcock.

On all of Hitchcock's visits bats were banded in conjunction with certain studies which he was undertaking. Eardley-Wilmot's material was forwarded to the National Museum at Ottawa. Lanning's material is in his own collection. The material in Brown's collection is mostly from Fourth Chute and the Petawawa Forest Experiment Station. Hitchcock (1949) has described in detail his observations and banding operations in Renfrew County and other parts of Ontario and Quebec.

Lanning estimated the bat population on his first visit to the Craigmont mine to be in excess of 10,000 individuals. On later visits the population was very much diminished as a result of certain operations which had been carried out, including the use of a hose on the walls.

It is of interest to note that at the Craigmont shaft, which is about 350 feet long and which proceeds approximately horizontally into the hillside, the entrance is quite wet and in winter is covered with icicles. A few feet inside the opening columns of ice resembling stalagmites rise from the floor of the shaft. Further in the the temperature becomes quite warm, about 39°F. (at the same time as an outside temperature of about -30°F.). In the autumn the temperature inside the shaft was about 45°F. The bats hibernated in the area which had an approximately even temperature all year. They did not penetrate in large numbers to the inner end of the tunnel but congregated in greatest numbers about half way along its length.

7. *Myotis lucifugus lucifugus* (LeConte)

LITTLE BROWN BAT. Hitchcock found one male and one female at Fourth Chute on February 26, 1944; these are now in the National Museum collection. Twenty-three skins, also in the National Museum, are from a total of 372 males and 119 females taken from the Craigmont mine by Eardley-Wilmot on October 6, 1944.

On February 26, 1945, Hitchcock recorded a very large number of bats in the Craigmont shaft. Most of them were *M. l. lucifu-*

gus, of which he examined and banded 180 males and 41 females. Approximately 3800 bats were present in the shaft at this time, the largest congregation Hitchcock had ever seen in Canada. On November 28, 1947 he recorded 612 males and 199 females in the Craigmont shaft. On January 4, 1947 two males and one female were present in the Fourth Chute cave.

Three specimens (two males and one female) in the Brown collection are from Cobden. The two males averaged L., 94; T., 39; H.F., 10; 'wing', 120; forearm, 38.5; thumb, 6; tragus, 6. Measurements of the female were L., 93; T., 38; H.F., 10; forearm, 38; thumb, 6; tragus, 6. Lanning has one specimen (L., 81.5) from Golden Lake, July 23, 1936.

Dr. Rand reports that Eardley-Wilmot, while prospecting the Craigmont shaft with a short-wave fluorescent lamp, noted that the ears, nostrils, wings and feet of the bats were outlined in olive-green under the lamp. Three of the live bats that were taken to Ottawa by Eardley-Wilmot were examined by Dr. Rand with a miner's fluorescent lamp. Under the purple light the fur was purple, but the ears were a vivid olive-green and the wings were olive-green, the colour being intensified on the wing bone.

8. *Myotis keenii septentrionalis* (Trouessart) TROUESSART'S MOUSE-EARED BAT. The following skins are in the National Museum collections: six, collected by Hitchcock at Fourth Chute on January 6, 1943; six, collected by Hitchcock and Rand at Fourth Chute on February 26, 1944; one, collected by Eardley-Wilmot at the Craigmont mine on October 6, 1944; three, collected by Hitchcock at Fourth Chute on February 25, 1945; eight, collected by Rand at Fourth Chute on January 20, 1946.

Brown has two skins (one male, one female) from Fourth Chute, April 5, 1942 and one male from Petawawa Military Reserve, August 18, 1942. The two males averaged L., 87.5; T., 40; H.F., 9; 'wing', 111.5; forearm, 35.5; thumb, 7; tragus, 9; weight, 5.98 grams. Measurements of the female were L., 91; T., 43; H.F., 9; 'wing', 118; forearm, 37; thumb, 7; tragus, 9; weight, 5.55 grams.

The following is a record of the number of this species counted by Hitchcock at Fourth Chute: April 5, 1942 — 7 males, 3 females; January 6, 1943 — 19 males, 7

females; February 26, 1944 — 21 males, 7 females; February 25, 1945 — 8 males, 10 females; January 4, 1947 — 15 males, 4 females; November 29, 1947 — 14 males, 2 females.

The following bats of this species were counted by Hitchcock at the Craigmont shaft: February 26, 1945 — 5 males, 2 females; November 28, 1947 — 44 males, 11 females (estimated total population of this species was 230).

The specimen noted above was the only individual of this species recorded from the Craigmont mine by Eardley-Wilmot on October 6, 1944.

9. *Myotis subulatus leibii* (Audubon and Bachman)

LEIB'S MASKED BAT. Skins in the National Museum collection, all from Fourth Chute, are as follows: six, collected by Hitchcock on January 6, 1943; fourteen, collected by Hitchcock and Rand on February 26, 1944; two, collected by Hitchcock on February 25, 1945; fourteen, collected by Rand on January 20, 1946.

Two skins (one male, one female) from Fourth Chute, April 5, 1942 are in the Brown Collection. Measurements of the male are L., 89; T., 36; H.F., 7; 'wing', 108; forearm, 32; thumb, 5.5; tragus, 6. Measurements of the female are L., 87; T., 37; H.F., 7; 'wing', 110; forearm, 33.5; thumb, 5.5; tragus, 6.

The following bats of this species were counted by Hitchcock at Fourth Chute: April 5, 1942 — 18 males, 12 females; January 6, 1943 — 40 males, 36 females; February 26, 1944 — 71 males, 71 females; February 25, 1945 — 44 males, 38 females; January 20, 1946 — 5 males, 4 females (incomplete census); January 4, 1947 — 45 males, 29 females; November 29, 1947 — 16 males, 5 females.

Hitchcock (1945) has published a short note on the occurrence of this bat in Ontario.

10. *Lasionycteris noctivagans* (LeConte)

SILVER-HAIRED BAT. The single record consists of a female in the Royal Ontario Museum of Zoology and Palaeontology, taken at Petawawa by Mr. T. M. Shortt on June 28, 1935.

11. *Pipistrellus subflavus obscurus* Miller

DUSKY PIPISTRELLE. The following skins, all from Fourth Chute, are in the National Museum collection: five, collected by Hitch-

cock on January 6, 1943; six, collected by Hitchcock and Rand on February 26, 1944; three, collected by Rand on January 20, 1946.

The following is a record of the number of this species counted by Hitchcock at Fourth Chute: April 5, 1942 — 6 males; January 6, 1943 — 10 males; February 26, 1944 — 16 males, 2 females; February 25, 1945 — 5 males; January 4, 1947 — 10 males, 2 females; November 29, 1947 — 7 males, 1 female.

12. *Eptesicus fuscus fuscus* (Beauvois)

BIG BROWN BAT. Skins in the National Museum collection, all from Fourth Chute, are as follows: one, collected by Hitchcock and Rand on February 26, 1944; three, collected by Rand on February 25, 1945.

The following is a record of the number of this species counted by Hitchcock at Fourth Chute: April 5, 1942 — 27 males, 7 females; January 6, 1943 — 171 males, 37 females; February 26, 1944 — 143 males, 38 females; February 25, 1945 — 139 males, 43 females; January 20, 1946 — 70 males, 18 females (incomplete census); January 4, 1947 — 33 males, 5 females; November 29, 1947 — 17 males, 3 females.

13. *Procyon lotor lotor* (Linnaeus)

EASTERN RACCOON. On August 23, 1943 excellent tracks of this species were discovered on the wet sand at Combermere and were carefully measured and sketched. This identification was later verified. On August 12, 1944, a dog drove to cover in some old buildings an animal which, from a fleeting glimpse, was identified as this species. Renfrew County appears to be on the northern fringe of the range of the raccoon.

14. *Euarctos americanus americanus* Pallas

AMERICAN BLACK BEAR. This species is never very plentiful but because of general conditions in the area and its proximity to Algonquin Park it is not unusual to find the occasional individual. They were reported most years around Combermere. Edwards found them at Bark Lake and Brown reported them on several occasions from the Petawawa Military Reserve. Mr. Sheldon Davis of Eganville cited several instances of hunters shooting bears, especially during the deer hunting season. He recorded one still active in late November 1947.

The population is increasing, the greatest increase apparently being in the Stonecliff area.

15. *Vulpes fulva fulva* (Desmarest)

EASTERN RED FOX. One was seen near Centre Lake on the Petawawa Military Reserve by the driver of a National Forestry Program truck on September 12, 1939. Brown reported this species as being uncommon in the area although on the night of July 23, 1942, he heard what were believed to be foxes barking just west of the Petawawa Forest Experiment Station headquarters.

One was reported to R. Y. Edwards as being seen in 1941 at Bark Lake. At Combermere they were common and were occasionally heard barking around farms where turkeys were being raised. In February 1948, when Lanning visited Eganville, fox tracks were in evidence everywhere.

Since 1948 there has been a sharp increase in the fox population throughout the county, probably due to the small demand for pelts. A specimen taken at the Pembroke Forestry Station was unusual as it was infested with a parasite not usually found in the area.

16. *Canis latrans latrans* Say

NORTHERN COYOTE. Davis, at Eganville, reported an individual of this species being shot in January 1948. The species is most common in areas composed of about 40 percent farm land and 60 percent woodland. Populations are apparently decreasing from the 1950 level.

Due to the difficulty of exact sight identification, reports of 'wolves' might refer to this species, or to the Timber Wolf, or possibly to a cross of coyote X dog.

17. *Canis lupus lycaon* Schreber

EASTERN TIMBER WOLF. D. E. Gray of the Department of Agriculture saw a timber wolf at Lone Creek on the Petawawa Military Reserve in August 1936. On August 22, 1939 wolves assumed to be of the present species were heard howling south of the Petawawa Forest Experiment Station Headquarters.

In August 1940 six or seven wolves were reported lying on the highway at night near Combermere. In 1938 wolves were heard howling several times in this locality.

Lanning was informed that both species of wolves occurred occasionally near Combermere and were trapped. Both species were carefully described and it would appear justifiable to assume that this information was correct. No estimate was made as to the relative abundance of the two species.

The timber wolf is now (1953) common in those sections of the County adjoining Algonquin Park.

A report has appeared in a Renfrew newspaper of a pack of wolves attacking a steer. The animal was seriously wounded and died shortly after the attack.

18. *Martes americana americana* (Turton)

MARTEN. This fur-bearer is showing signs of increasing under the present trap line management scheme. Sixteen pelts were taken in 1950-51 and 37 in 1952-53.

19. *Martes pennanti pennanti* (Erxleben)

FISHER. Old time residents advise that the fisher was fairly common at Combermere 25 years ago but now they are extremely scarce, one being seen every three or four years. Davis reports them as occasionally seen in the McKay-Fraser township area and cites a specific date as November 12, 1947.

This species is apparently on the increase in the county judged by trapping returns for 1951-52 of 56 pelts and for 1952-53 of 173 pelts. Some of these animals could be an overflow from Algonquin Park.

20. *Mustela erminea cicognanii* Bonaparte

BONAPARTE'S WEASEL. Brown records that this species is commonly taken by the commercial trappers. The best information Lanning could obtain was that it was not commonly taken although it was not rare. Several brown individuals, presumably of this species, were observed during the summer. Brown saw one in summer pelage at the Petawawa Forest Experiment Station. Mr. A. Cringan reported seeing an individual of this species on August 8, 1943 at Griffith.

Brown has a specimen taken in winter pelage near Chalk River in the late autumn of 1942 by Jack Johnson.

21. *Mustela vison vison* Schreber

COMMON EASTERN MINK. Lanning was informed that this species was commonly taken near Combermere and Brown found a similar situation at Chalk River. This is one of the most valuable fur-bearers of the region.

Brown has a record of one observation on June 2, 1940 at the Petawawa Military Reserve. Lanning observed one while drifting in a canoe on August 13, 1943. A specimen of this species in the National Museum (No. 1884) was taken in Sebastapol Township.

The population is apparently remaining constant.

22. *Lutra canadensis canadensis* (Schreber)

EASTERN CANADA OTTER. Lanning saw otters at Green Lake near Combermere and was informed that they were there each year. Apparently if sought after they are not difficult to find. At least a part of the population of the county could quite reasonably be considered an overflow from the stock in Algonquin Park. Populations appear to remain steady.

23. *Mephitis mephitis mephitis* (Schreber)

NORTHEASTERN STRIPED SKUNK. Usually common on the Petawawa Military Reserve; at times considerable numbers were found around the garbage pits at the Petawawa Forest Experiment Station headquarters, becoming quite a hazard to walking after dark. At Combermere they were found to be rather scarce, not being recorded for several years.

Mr. R. Y. Edwards found the species at Bark Lake in August 1941 and Mr. A. Cringan found it at Griffith on July 14, 1943.

The population has increased from 1950 to 1953, skunks now being very common in the farming areas of the south and east parts of the region.

24. *Lynx canadensis canadensis* Kerr

CANADA LYNX. Very rare. We are advised of two or three recent sight and sound records which make us believe that this species is still present in the district.

25. *Lynx rufus rufus* (Schreber)

BOBCAT. This species may occasionally be recorded. During the course of a conversation with a local trapper at Combermere the following information was obtained in regard to this species, which was carefully differentiated from the lynx — "An individual was seen or trapped about once in every two years." As for the Canada Lynx, he said — "...once in every three or four years".

26. *Lepus americanus virginianus* (Harlan)

VARYING HARE. Found sparingly at the Petawawa Military Reserve in the summers of 1938 to 1942 inclusive. A juvenile male was taken by Brown on June 22, 1940. This species was also recorded at Lake Dore and Combermere by Lanning.

A female in the collection of the National Museum (No. 17,117), collected by C. H. D.

Clarke at Black Donald on November 17, 1941, was still in summer coat although a slight whitening was showing in the back and legs. This specimen was referable to *virginianus* although intergrading with *L. a. americanus*.

Although this species was seldom observed in the summer, tracks were very common in February 1948 when Lanning visited the area and four specimens, all in full white pelage, were taken.

Three adult females averaged L., 465; T., 50; H.F., 145.

27. *Sylvilagus floridanus mearnsii* (Allen)

MEARNS' COTTONTAIL. At Combermere on August 17, 1943 Lanning flushed a cottontail at close range from some scrub and had an opportunity to study it carefully. Mr. Davis advises that he has recorded one or two from Eganville.

28. *Marmota monax rufescens* Howell

RUFESCENT WOODCHUCK. Very common on the Petawawa Military Reserve, the light, sandy soil in this area being much to the liking of this species. Recorded by Edwards as frequently seen near Bark Lake. Not uncommon at Lake Dore and Combermere.

An interesting observation was recorded by Brown as follows: "I watched a woodchuck being chased up a tree by a small dog. The animal climbed the tree (about seven inches in diameter) to a height of about twelve feet and remained spread-eagled on the trunk until the dog had left, after which it backed down to the ground."

Some of the animals examined from the Petawawa Military Reserve were very dark and a few were almost pure black. This melanistic phase is quite common in this area.

29. *Tamias striatus lysteri* (Richardson)

NORTHEASTERN CHIPMUNK. This species was recorded as very common throughout the area. Brown found it in the larch swamps, in hardwood bush and red pine plantations on the Petawawa Military Reserve. He recorded it as common at Golden Lake. Lanning found it common in all habitats at Combermere and especially common on the rock outcroppings at Lake Dore in 1946.

Certain specimens were forwarded to Dr. A. L. Rand for identification and he advised as follows: "Referable to *T. s. lysteri*... the

above series compares much better in paler dorsal colouration (paler head and rump; grayer back) with New Brunswick series than it does with Manitoba specimens of *griseus* and are unhesitatingly referred here."

Thirty-one adult male specimens averaged L., 239; T., 96; H.F., 35; weight (ten specimens) 79.3 grams, with extremes being L., 263-195; T., 112-80; H.F., 38-33; weight 100-33.4 grams.

Thirty female specimens averaged L., 241; T., 97.5; H.F., 35; weight (13 specimens) 70.7 grams, with extremes being L., 266-205; T., 107-86; H.F., 39-31; weight 95.2-51.7 grams.

30. *Tamiasciurus hudsonicus loquax* (Bangs)
SOUTHERN RED SQUIRREL. Reported as common in a variety of habitats on the Petawawa Military Reserve. Mr. Edwards advised that it was common at Bark Lake and Lanning found it at Combermere, Lake Dore and Golden Lake. The Royal Ontario Museum field party in 1935 also took it at Stonecliffe.

A specimen submitted to Dr. A. L. Rand for examination was returned with the following comments: "*T. h. loquax* ... In brighter, redder dorsal colouration, with wide, distinct and brightly coloured dorsal streak, this specimen compares better with Ottawa and farther south specimens than it does with the duller *hudsonicus* from western Ontario and Manitoba."

Nine males averaged L., 291; T., 114.5; H.F., 48; weight 163 grams, with extremes being L., 324-262; T., 125-102; H.F., 51-42; weight 179-150 grams.

Six females averaged L., 299; T., 121; H.F., 46.2; with extremes being L., 313-285; T., 127-117; H.F., 48-42.

Macnamara (1943) published a short article on the food of the red squirrel. The material for this paper was collected near Arnprior in the south-eastern corner of the county.

31. *Sciurus carolinensis leucotis* (Gapper)

NORTHEASTERN GRAY SQUIRREL. Seton (1911) recorded seeing a specimen (in the black phase) that was killed near Pembroke in November 1909, and noted that two others were taken about 1904. Davis has occasionally recorded this species from the hardwood stands near Eganville and Lanning has one record from Combermere. All recent records have been of the black phase.

32. *Glaucomys sabrinus macrotis* (Mearns)

MEARNS' FLYING SQUIRREL. One specimen was taken by Brown at Petawawa and one by Lanning at Combermere; Lanning also has several sight records. Despite these few records, trappers report that flying squirrels are quite common and that many are trapped each fall when they are robbing traps set for other fur-bearers.

33. *Castor canadensis canadensis* Kuhl

CANADA BEAVER. Brown observed one on August 17, 1939 on the Barron River in the south end of the Petawawa Military Reserve. Several dams are in existence on the Reserve, one of the largest, which is near Maunsel Lake, being about 100 feet long. Chalk River trappers advised Brown that a few animals of this species are taken in the region but that neither they nor their workings are as common here as in many other parts of the province.

Lanning observed workings and 'maintained' dams in several places and was advised that trappers still took a few each season, particularly in areas bordering Algonquin Park. Current estimates now place the population at 1,000 active houses.

As a result of the sound management policy laid down by the Ontario Department of Lands and Forests and because of the excellent co-operation of the trappers, the beaver is rapidly increasing; 639 pelts were taken in 1951-52 and 950 in 1952-53.

34. *Peromyscus maniculatus gracilis* (LeConte)

LECONTE'S WHITE-FOOTED MOUSE. Brown found this to be one of the commoner species in the Petawawa Military Reserve, individuals being taken in the larch swamps, hardwood bush and red pine plantations.

Edwards found this species at Bark Lake, the Royal Ontario Museum party found it at Stonecliffe in 1936 and Lanning found it common at Combermere. At Combermere, 1943 appeared to be a year of great abundance.

There is one specimen in the Royal Ontario Museum collection which has tentatively been identified as *Peromyscus leucopus noveboracensis* (Fischer) but the population as a whole is referable to *P. m. gracilis*. Further study may uncover more specimens of *leucopus*, particularly in the southern edge of the county.

Forty-six adult males averaged L., 168; T., 82.5; H.F., 21; weight (22 specimens)

16.9 grams with extremes of L., 197-151; T., 93-69; H.F., 22-19; weight 25.5-12.7 grams.

Twenty-five adult females averaged L., 169; T., 81; H.F., 20.5; weight 16.0 grams with extremes of L., 200-151; T., 95-69; H.F., 22-19.

35. *Synaptomys cooperi cooperi* Baird

COOPER'S LEMMING MOUSE. Brown trapped three in a larch swamp at Petawawa. The Royal Ontario Museum party in 1936 took three at Golden Lake and Lanning trapped three at Combermere on the top of a dry rocky hill almost 800 feet above the surrounding country.

Four males averaged L., 100; T., 17; H.F., 18; weight (two specimens) 16.0 grams, and five females averaged L., 118; T., 20; H.F., 18.3; weight (1 specimen) 27 grams.

36. *Clethrionomys gapperi gapperi* (Vigors)

GAPPER'S RED-BACKED MOUSE. Brown trapped 57 individuals in larch swamps: in 1941 this was the second most common mammal taken. Lanning found it at Combermere and the Royal Ontario Museum field party took it in 1936 at Golden Lake.

Fifty adult males averaged L., 130; T., 35; H.F., 18; weight (37 specimens) 19.8 grams, with extremes of L., 147-115; T., 43-29; H.F., 23.5-17 (one measurement of H.F. — 11).

Fourteen females averaged L., 135; T., 37; H.F., 18; weight 21.5 grams, with extremes of L., 150-118; T., 42-30; H.F., 19-18; weight 42.8-14.7 grams.

37. *Microtus pennsylvanicus pennsylvanicus* (Ord)

PENNSYLVANIA MEADOW MOUSE. Brown took this species in larch swamps and one was trapped in hardwood forest. Lanning took it at Combermere on the dry bracken plains as well as in wet swamps. Edwards found it at Bark Lake and the Royal Ontario Museum party took it at Stonecliffe, Petawawa and Golden Lake.

Eighteen males averaged L., 154; T., 47; H.F., 21; weight (twelve specimens) 33.5 grams with extremes of L., 181-123; T., 56-37; H.F., 22-19; weight 52.0-19.9 grams.

Eleven females averaged L., 155; T., 47; H.F., 21; weight (seven specimens) 29.9 grams, with extremes of L., 165-145; T., 52-44; H.F., 22-19; weight 36.7-22.7 grams.

38. *Ondatra zibethica zibethica* (Linnaeus)

EASTERN MUSKRAT. A muskrat house was present on the Petawawa Military Re-

serve near the mouth of Moose Grove Creek, which empties into the west side of Cartier Lake. This house had been seen many times but was definitely recorded on July 26, 1942.

Conroy's Marsh near Craigmont had a very heavy muskrat population and in fact was at one time the site of a muskrat farm, a venture which did not prosper. However, the marshy banks and inlets of the Madawaska River in the neighbourhood of Combermere provide excellent habitat for this species and make it one of the most important furbearers of the region.

Populations are currently up in the county, probably as a result of the increased beaver population and dams.

39. *Rattus norvegicus* (Erxleben)

HOUSE RAT. Davis reported that rats are present at Eganville and Rankin and probably in the other larger towns.

40. *Mus musculus domesticus* Ruddy

HOUSE MOUSE. The only definite record is a specimen taken by the Royal Ontario Museum party in 1935 at Petawawa. This species, like the previous one, probably is found in the larger towns, especially those adjacent to the railroad.

41. *Zapus hudsonius ontarioensis* Anderson

ONTARIO JUMPING MOUSE. Edwards took this species at Bark Lake and found that it had a decided affinity for the garbage pit which was in a pine plantation. Brown trapped it at Petawawa in the larch swamps and red pine plantations. Lanning took it at Combermere in a beaver meadow and red pine plantation.

Males and females showed no variation in measurements when averaged separately and are therefore grouped. Twenty specimens averaged L., 205; T., 126; H.F., 30; weight 16.4 grams.

42. *Napaeozapus insignis algonquinensis*
Prince

ALGONQUIN WOODLAND JUMPING MOUSE. Trapped by Brown commonly in the larch swamps. Also taken in a red pine plantation and along a brook running through hardwood forest, as well as at garbage pits. Edwards took it at Bark Lake and Lanning found it common at Combermere, especially in wet second growth deciduous stands.

Most of Brown's skins were examined by Prince (1941) and used as collaborating

material when he described the present subspecies. The area being discussed is not more than 50 miles from the type locality of the subspecies at Smoke Lake.

Males and females showed no variation when the measurements were averaged separately and are therefore grouped. Sixty-three specimens averaged L., 228; T., 141.5; H.F., 31; weight 18.4 grams, with extremes of L., 267-193; T., 161-115; H.F., 34-29; weight 29.9 grams.

43. *Erethizon dorsatum dorsatum* (Linnaeus)
EASTERN CANADA PORCUPINE. This animal is fairly common over the whole of the Petawawa Military Reserve and is seen frequently when travelling through the forest.

The porcupine is particularly fond of the bark of white pine which has been attacked by the fungus causing white pine blister rust. Many girdled branches and large areas of branches and trunks from which the bark has been stripped have been observed. The bark of larch trees is also a preferred food of this species and it has been found necessary to protect European larch trees from depredations by this species by surrounding the trunk with wire screening placed around the trunk at a distance of about one foot.

This species was recorded from Combermere in 1941 only, but was found at Golden Lake in August 1944. In February 1948 tracks and girdled trees were quite common near Rankin. Populations in the county are down, perhaps due to the pressure exerted by the excess fox population.

44. *Odocoileus virginianus borealis* (Miller)
NORTHERN WHITE-TAILED DEER. Recorded commonly every summer from the Petawawa Military Reserve, a place of especial abundance being the jack pine flat just north of the Petawawa River, in the vicinity known as 'Racehorse'.

Lanning recorded it as common at Combermere and found it in February 1948 near Golden Lake. Edwards found it at Bark Lake. On June 7, 1942, R. O. Standfield and Brown overtook a deer swimming across the Chalk River below Corry Lake and took several photographs from their canoe.

The tourist industry is of major importance in this area and the fall deer hunt is one of the most important attractions offered; this makes the species of major economic importance to the area.

Numbers were down in 1953 compared to 1952 in spite of an open, mild winter.

45. *Alces americana americana* (Clinton)

EASTERN MOOSE. Recorded by E. F. G. White as common in 1910 at Westmeath; in later years he advised that records of the species became quite unusual.

Lanning's only record is of a cow and calf in August 1942 at Combermere.

On June 23, 1939 C. H. Zavitz and Brown watched a bull moose standing in the water of one of the Bays of Cartier Lake, Petawawa Military Reserve. Although only twenty feet from shore he was exceedingly wary and would not permit approach even close enough for a photograph, the result being that they only succeeded in getting a small black spot representing the moose on the best film available.

On July 26, 1942 a moose was seen swimming from an island to the south shore of Cartier Lake by J. E. Brown and Brown.

Although not common in the area under consideration it is of fairly regular occurrence in very small numbers. Because of its large size and ability to cover large areas a single animal is probably recorded by many people, making it appear more common than it really is. Current estimates place the population at about 40 individuals.

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NOTES AND OBSERVATIONS

FROG-BIT (*Hydrocharis morsus-ranae* L.) IN OTTAWA RIVER¹ — The persistence of the European frog-bit from its original introduction to the Arboretum in 1932, and its subsequent spread into the adjoining Rideau Canal, has already been reported by Minshall in 1940 (Can. Field-Nat. 55: 44-45). During subsequent years, masses of this small aquatic plant, have been noticed free-floating in the Rideau Canal at points about a mile below the Arboretum. In 1947, it had entered Brown's Inlet, an artificial basin connected to the Rideau Canal by an underground culvert, and in 1953 vigorous nets of the plant were found to be spreading there among the *Butomus umbellatus* and other

shoreline plants, along much of the margin of the lower portion of the inlet.

Since the Rideau Canal is drained of its waters each autumn by the opening of sluices into the Ottawa River, it has been expected that the frog-bit would sooner or later be found downstream in the Ottawa. On August 18, 1953, frog-bit was collected along the south bank of the Ottawa, about 3 miles above Cumberland some 13 miles below the exit of the canal (specimen No. 3552 L. Jenkins & W. G. Dore). Here it was spreading on the soft mud among cat-tails and other tall marsh species in a drying lagoon paralleling the river. This lagoon, as well as much of the surrounding land, is completely submerged by the spring flood-waters of the river.

¹ Contribution No. 1352 from the Botany and Plant Pathology Division, Science Service, Department of Agriculture, Ottawa, Canada.

On enquiry of M. Raymond of the Montreal Botanic Garden, I learn that he identified a specimen of *Hydrocharis morsus-ranae* brought to him by A.H. Pattison during the summer of 1953. This specimen was collected at Rosemere, Quebec, floating in Rivière des Mille-Iles, August 26, 1952, and is now preserved in the herbarium of McGill University. Rivière des Mille-Iles is the branch of the Ottawa River which passes on the north side of the Hochelaga Archipelago near Montreal. This was the first time Mr. Raymond knew of the plant growing outside of the Botanic Garden pools.

The origin of the Rosemere plants is not known, but it may be that they represent a further extension of the Ottawa infestations. If so, other patches should be looked for in the intervening 90 miles of Ottawa River between Rosemere and Cumberland, or even in the waters below Rosemere.

Recent manuals covering the flora of North America have no listing of *Hydrocharis morsus-ranae*, so the above occurrences are concluded to be the only naturalized stands of the plant yet known on the Continent.

W. G. Dore, Ottawa.

Three observations of predators attacking prey. — No. 1 Red-tailed Hawk Killing Crows.

On June 16, 1950 an engine break-down in the boat used to undertake the fifth census of non-passerine birds in the bird sanctuaries along the north shore of the Gulf of St. Lawrence made it necessary for the writer to spend two weeks in a small cove near Matamec Harbour, 25 miles east of Seven Islands, Quebec, to undertake necessary repairs. Local walks had established that a pair of crows (*Corvus brachyrhynchos*) had a nest with two young in a spruce tree near the water's edge. At 2.30 p.m. on June 28 a Red-tailed Hawk (*Buteo jamaicensis*) was seen to approach the vicinity of the nest. The two adult crows commenced raucous cawing but made no attempt to drive away the approaching hawk. The hawk flew into the nest and, after much noise on the part of the crows, was observed to start to carry off one of the nearly full-grown young. The second young crow flew out from the nest across the water and fell into the bay, drowning quickly. The hawk dropped its prey on the beach to fend off the attacks of the two adult crows and flew off. While the hawk was carrying its prey the sounds of the crows were almost human in their tone and inflec-

tion. One would think that a child was wailing over a lost doll. The spruce grove settled down shortly after the hawk disappeared. About an hour later a black bear (*Euarctos americanus americanus*) was observed to walk along the beach, pick up the dead young crow and eat it, climaxing an interesting episode.

No. 2 Polar Wolf Attacking Arctic Hare.

While engaged in the study of the ecology of musk-oxen near Slidre Fiord, Fosheim Peninsula, Ellesmere Island, N.W.T., from April 19 to August 24, 1951, the writer recorded an interesting observation of a Polar Wolf (*Canis lupus arctos*) approaching and attacking a herd of 125 Arctic Hare (*Lepus arcticus monstabilis*). The observation was made at 3.00 a.m. in sunlight on August 10.

The writer happened to be watching, through 10 x 50 binoculars, the above herd of hare grazing over an area of about an acre on a hillside on the south shore of Slidre Fiord when a white wolf suddenly appeared slightly below and to the left of the hares. The wolf singled out an individual at the edge of the herd and chased it through the herd. Two unusual reactions were then observed, for the hare that was chased hopped rapidly on its hind legs much like a kangaroo and the remaining hares, after the initial alarm was experienced, paid little attention to the wolf running through the herd. The pursued hare ran in a zig-zag manner through the herd and then left it to ascend the hill where the wolf captured it just below the top. Subsequent observations of hare confirmed this earlier record that this animal hops rapidly on its hind legs when closely pursued.

No. 3 Golden Eagle Killing a Canada Goose.

Dr. John E. Bardach and the writer were descending by canoe the Thelon River, near Hornby's Bend, N.W.T., on July 24, 1952, in the course of a musk-ox investigation, when a flock of approximately 200 Canada Geese (*Branta canadensis*) was sighted 200 yards ahead. A Golden Eagle (*Aquila chrysaetos canadensis*) was seen to swoop down on the flock resting on the river. Most of the geese took flight but some had not completed their moult and were forced to flee towards shore, several leaving the water for the shelter afforded by willows and spruce near the beach. The eagle meanwhile had gained altitude and, seeing a goose on the beach, attacked it, killing the goose instant-

ly. The goose was retrieved by the writer for the National Museum of Canada. Examination showed several punctures along the back and severe haemorrhage at the base of the skull.

J. S. TENER, Banff, Alberta.

Further notes on the birds of Banff National Park, Alberta. — Further observations on the bird life in Banff National Park in 1953 has produced additions and noteworthy changes in status to the bird lists prepared by Clarke and Cowan (1945) and Banfield (1953).

ANNOTATED LIST

Eared Grebe. *Colymbus caspicus* Hablizl.

Two Eared Grebes were observed on the Third Vermilion Lake, on May 1, 1953, among a large flock of four species of divers. The next day they were gone.

Ring-necked Duck. *Aythya collaris* (Donovan).

A pair of Ring-necked Ducks was observed on the Second Vermilion Lake, from May 1 to June 1, 1953.

Common Golden-eye. *Glaucionetta clangula* (Linnaeus).

Clarke and Cowan (*op. cit.*) reported that the Common Golden-eye occurred in the Park during the winter and migrations, but was replaced by Barrow's Golden-eye (*Glaucionetta islandica* Gmelin) during the breeding season. My previous observations confirmed this generalization. A pair of Common Golden-eyes, however, was observed on a small slough near Johnson Lake on June 4, 1953.

Surf Scoter. *Melanitta perspicillata* (Linnaeus).

A flock of twenty Surf Scoters was observed on the Lower Waterfowl Lake, on May 23, 1953. Surf Scoters were common in Jasper National Park during the spring migration, but this was the first record for Banff National Park.

Ruddy Duck. *Oxyura jamaicensis* (Gmelin).

A female was seen on the Second Vermilion Lake on June 1 and 4, 1953.

American Coot. *Fulica americana* Gmelin.

An unusual winter record for the coot was obtained when one was observed in a

small spring hole in the ice of the Third Vermilion Lake on February 8, 1954 by Mr. J. S. Tener and the writer.

Red Phalarope. *Phalaropus fulicarius* Linnaeus.

Mr. W. W. Mair, Mr. R Webb and the writer observed four female Red Phalaropes in nuptial plumage on the North Saskatchewan River near Graveyards cabin on May 23, 1953.

Common Tern. *Sterna hirundo* Linnaeus.

A Common Tern was observed over Johnson Lake, on June 4, 1953.

Little Boreal Owl. *Cryptoglaux funerea* Linnaeus.

Mr. Dick Bird of Regina, Saskatchewan, showed me a Little Boreal Owl roosting in an abandoned flicker's nesting hole in an aspen stub at Muleshoe Lake, 9 miles west of Banff, on May 28, 1953. Mr. and Mrs. Bird found several holes occupied by these owls near Hillsdale cabin at this time.

Steller Jay. *Cyanocitta stelleri* (Gmelin).

The Steller Jay is rare enough in the Banff region to warrant the recording of an observation of two at Anthracite on April 1, 1953.

Blue-headed Vireo. *Vireo solitarius* (Wilson).

Single singing males were observed at Banff, on May 9, 1953, and Johnson Lake, on June 4, 1953.

Magnolia Warbler. *Dendroica magnolia* (Wilson).

A singing male was seen near the Cave and Basin Hot pool, on May 28, 1953.

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Canadian Wildlife Service,
Ottawa, Ontario.

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